Getting the Truth:
A Qualitative Comparative Analysis of Rural Nurses' Attitude to Safety Climate and their Views of Reporting a Hypothetical Medication Error

by

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The research associated with this thesis abides by the international and Australian codes on human and animal experimentation, as approved by the Human Research Ethics Committee (Tasmania) Network – Health and Medical, Ethics Reference No. H0011688.

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Abstract

Interventions to prevent error and improve error management have been central to health care safety and quality research. To achieve this, any error needs to be reported formally and should also be acknowledged to the patient/consumer or their family. Appropriate organisational culture is regarded as a means of assisting these actions.

Error management is important to the health system, clinicians and most importantly for consumers. When an error occurs it can lead to harm, which itself can be traumatic, but this in turn can lead to increased costs both to the system and to the consumer. Clinicians involved in error, along with their colleagues, also suffer when harm occurs as a result of error. Most importantly, the consumer and/or their family suffer, including if the facts of an error are not fully disclosed.

This research aims to describe the complexity of safety climate amongst nurses working in rural clinical settings. It focuses on the nature of this complexity in relation to nurses' views of reporting medication error.

The framework for the research was underpinned by complexity science with health care viewed as a complex system where *evidence* and *sense-making* are forms of knowledge generation. A survey incorporating a safety attitudes questionnaire and a hypothetical medication error with multiple outcome scenarios (severe, moderate and near miss error) was used to collect data for this research. Variable analysis was undertaken along with case-based analysis using a configurational comparative method (CCM). This provided an additional means of analysing the data with each individual nurse considered a case.

Variable analysis found differences in both views of reporting and disclosure as well as safety climate and teamwork factors amongst reporting compared with disclosure, severity of harm from the error, workplace setting and work role. The results from the case-based configurations of factors of safety climate present for the outcomes in each

of these areas also demonstrated complexity existed in the relationship between the factors and views.

Some of these configurations suggest common assumptions made about culture and error reporting are not fully consistent with an outcome that an error would always be viewed as reported or acknowledged by each individual nurse. These assumptions need to be rethought, particularly those surrounding positive safety climate factors as being causal for improvements in error reporting and disclosure.

The case-based results also had implications for the concept of *resilience*. They suggest a need for more focus upon why error is reported and disclosed rather than looking primarily at why it is not occurring. Error management should be regarded as an intervention for safe patient care rather than an outcome of positive safety climate. In this way *resilience* to safety climate may be achieved.

Use of a configurational comparative method has provided for better understanding of safety climate and error within the complex and chaotic world in which health care delivery occurs. Shifting from a focus upon reductive approaches to research, that are driven by *evidence,* to one of expanding knowledge and *sense-making* helps with understanding the world of clinical practice where nurses work, and consumers receive health care. This informs both future research as well as the development of new theories for the delivery of safe patient care.

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There have been many who have helped me through the eight years of part-time study required to produce this thesis. It is with both a touch of sadness and an exciting anticipation of the future that I realise it is now over.

The saddest and most challenging part of the journey has been the loss of my original primary supervisor. The late Dr Erica Bell was integral to this research and without her input, particularly in relation to method and research design, the thesis would not be what it has become. No student expects that their primary supervisor will not read their finished work and yet that is what I now face. Not being able to share with her the key findings of some of the QCA results has perhaps been the most difficult aspect of writing up. However, allowing me to develop my own expertise has been crucial for me to be able to finish and I am ever grateful for her unselfish nature and guidance in this respect.

Thanks must also be extended to my other supervisors. My thanks go to Professor Sue Kilpatrick for her supportive co-supervision and for more recently stepping into the role of primary supervisor. Her patience and support across the whole journey is appreciated and reflects her expertise and commitment as well as her outwardly giving personality. Professor Rick Iedema has also provided invaluable input during the last stages of writing up. Having taken on the role of co-supervisor less than six months ago, his knowledge of the content and encouragement towards attaining the elusive goal of completion is both welcomed and appreciated.

I am also in debt to the Australian Nursing Federation and Health and Community Services Union who assisted me to obtain the data for this research through distributing to relevant areas of their membership. Without their support the survey would have been less visible and the number of responses received would undoubtedly have been lower.

Colleagues, friends and family have also been important supports along the way. My parents always encouraged pursuing education and this was the force that started me on the journey. My two sisters, Sharon and Rose, have endured the ups and downs, the former offering a restful place to stay when attending various conferences and meetings and the latter offering insights to the final path of my travels having recently finished her own PhD. Thanks to you both.

It is somewhat difficult to view what the future will be. However, the encouragement to move forward from here comes from the same source of inspiration as the original idea for the thesis itself and that is from the numerous nurses that I have crossed paths with on the way. From the former colleague who was involved in administering a fatal dose of a medication and the other work colleagues with whom I have experienced those “that was close” moments, to the nurses who have come up to me following a presentation of my data who have said “what you are doing is important”, without you all I think I may have taken the wrong pathway. More recent support from my colleagues at the School of Health Sciences at UTAS has also been important in me seeing this through.

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Finally, the respondents to the questionnaire require thanking. It is these 116 nurses who freely gave their time and honesty to what has been so crucial to the thesis existing at all. Whilst there may have been times when it was difficult for me to think the journey would ever end, it is the importance of ensuring the voice of those nurses is heard that has been an overriding influence to never give up.

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1 Introduction

Throughout our lives we all interact with the health care system. It commences at birth and continues until the end of life. As a result of this interaction the majority of us do not suffer harm. However, we know health care is not always as safe and effective as it should be and sometimes things can go wrong. When something goes wrong it may be unforeseeable harm, but there are times when things go wrong because someone has made a mistake.

These mistakes occur as the result of numerous factors. The clinicians who provide the care are human beings and human beings sometimes make mistakes. However, clinicians also work in a complex health system and sometimes it is something in the system that results in the clinician making a mistake and sometimes what is wrong in the system has been present in the culture of the system for some time.

The nature of culture is complex and difficult to define (Bennett, Grossberg, & Morris, 2005; Hollnagel, 2014; Williams, 1983). The behaviour, beliefs and attitudes relating to culture and safety are referred to as safety climate (Morello et al., 2013). In this research, the complexity of safety climate is researched in relation to different levels of harm that result when a clinician makes a mistake.

1.1 Background

The issue of patient safety in health care is important for consumers, clinicians and governments. Although the harm that may result from a mistake has an impact on the consumer or patient, there are additional issues that arise.

Clinicians do not like to hurt people and "first do no harm" has been central to their training. Therefore, when a mistake leads to harm it has an impact on the clinician and at times their colleagues as well. The term *second victim* is used to describe this outcome (Wu, 2000).

There are also issues relating to cost. The cost of medication error in Australia alone has been estimated at $AUS1.2 billion per annum (Australian Commission for Safety and Quality in Health Care, 2013b). Thus the prevention of error has important budgetary implications and governments are interested in reducing such costs.

It was in 1991 with the release of the *Harvard Medical Practice Study* (HMPS) (Brennan et al., 1991) that the issue of health care error arose to the fore. It estimated that 6.7% of hospital admissions resulted in an adverse event. A few years later an Australian study estimated the level of adverse events amongst hospital admissions at 16.7% (Wilson et al., 1995). Such levels of harm were considered unacceptable so a focus developed regarding how to improve outcomes as well as manage error when it occurred.

It was considered that for openness and transparency of error management a no-blame culture was needed (Kohn, Donaldson, Corrigan, & Institute of Medicine (U.S.). Committee on Quality of Health Care in America., 2000). Errors needed to be reported so that they could be examined, better understood and mechanisms for prevention could be developed (Kohn et al., 2000). Yet, after some twenty or more years since the issue was identified, there are still major incidents occurring in health systems globally.

Examples of such incidents include the events surrounding Mid Staffordshire Trust and Bristol Infirmary in the United Kingdom (UK) (Francis, 2013; Walshe & Offen, 2001). Similar examples can be found in Australia relating to Bundaberg Hospital in Queensland (Queensland Health, 2005) and Sydney's Royal North Shore Hospital (Skinner, Braithwaite, Frankum, Kerridge, & Goulston, 2009). All of these incidents were the subject of major public enquiries with each making similar recommendations, many of which reflect those of previous enquiries.

In some incidents errors are reported but nothing is done to remedy the situation. Examples of this include the events of Bristol Infirmary in the UK where the incompetent practice of a paediatric surgeon was known but was not dealt with until an anaesthetist went public about the issue. The Bundaberg Hospital incident in Australia was a similar event with nothing done regarding the similar incompetence of a surgeon until the issue was made public.

This differs from the situations relating from Mid Staffordshire Trust and Royal North Shore Hospital. The *Mid Staffordshire NHS Foundation Trust Public Enquiry* was conducted to determine why this organisation had a mortality rate much higher than similar facilities and found a culture of an acceptance of poor standard of care. That is, clinicians were not recognising poor practice.

In Australia, the inquest into the death of Vanessa Anderson, a 15 year old girl who died after receiving an overdose of a narcotic administered over a number of days at the Royal North Shore Hospital in Sydney, was scathing of the health system in particular the failure of clinicians to recognise serious issues in her care (Interprofessional Education for Quality Use of Medicines, 2014). It resulted in the instigation of a full enquiry into New South Wales Health. Amongst the findings were issues in relation to culture, not only within Royal North Shore Hospital but within the NSW Health system as a whole.

The issue of error management in the health system is not only limited to reporting. When a mistake is made, consumers like to know about it. Research suggests that when an error occurs if information is provided in an appropriate fashion the rate of litigation is reduced (Gallagher, Studdert, & Levinson, 2007).

There are also some unique aspects with regards to error management in the health care system. Care is delivered to individuals with complex needs in a variety of settings and when an error occurs it is often investigated at a local level thereby restricting any learning to that same level (Reason, 2013).

The importance of appropriate culture has been highlighted in the literature. Several studies have identified potential links between culture and the occurrence of error as well as error reporting. Other studies suggest any link is not clearly evident.

Some arguments suggest if we are to learn about safety there is a need to focus more on the many episodes of care that go well, rather than those where harm occurs (Hollnagel, 2014; Hollnagel, Braithwaite, & Wears, 2013). This would allow for learning about why things have gone as they should as opposed to constantly measuring error which is a focus on the non-presence of safety.

Such an approach is based upon the notion of complexity. Complexity theory has been associated with organisational failure resulting from error. Organisations are described as suffering from *"drifting into failure"* (Dekker, 2011, p. 14) over a period of time. Hence the argument for a greater focus on understanding what goes well rather than continually measuring what has gone wrong.

Complexity theory has also been used to inform approaches to research. In applying this alternative view to health care it is possible to adopt different approaches to the generation of knowledge. The dominant approach in health care research is evidence-based medicine which is one way of informing knowledge. Complexity theory is another which focuses more on sense-making as a means of using knowledge for understanding.

This research encompasses the aspects outlined here so far. More specifically, it examines the issue of safety climate and how it relates to nurses' views of reporting and disclosure.

Different frameworks for research require the use of different methods. This research applies a configurational comparative method (CCM), a method developed for the purpose of researching complexity.

Hence, the subject matter of this research relates to patient safety, in particular safety climate and views of reporting and disclosure amongst nurses. The context for this research is rural clinical settings in Tasmania. A configurational method applied within a framework of knowledge generation within health care as a complex system forms the process for this research.

As the subject matter and process for this research may not be familiar to all who read this document an overview of the key terms used will be now undertaken. Following this, further details of the research will be provided.

1.2 Key terms

The subject matter of this research, along with the method used requires an understanding of terminology appropriate to each. Although terms will be defined in the following chapters, a summary of the key terms used in this research is provided here.

Table 1-1 *Key terms used in this research*

Key terms (error and safety climate)	
Error	"Failure to carry out a planned action as intended or application of an incorrect plan" (Australian Commission for Safety and Quality in Health Care, 2013a, p. 2)
Adverse event	An incident in which harm resulted to a person receiving health care (Australian Commission for Safety and Quality in Health Care, 2013a)p2
Reporting	Incident management consists of the recognition, reporting and analysis of incidents to improve patient safety systems (Australian Commission for Safety and Quality in Health Care, 2011, p14). The term *reporting* is used in this thesis to indicate the formal notification of error as part of incident management.
Medication error	Any preventable event that may cause or lead to inappropriate medication use or patient harm (Australian Commission for Safety and Quality in Health Care, 2013a, p. 2)
Near miss	An incident that does not cause harm but had the potential to do so (Australian Commission for Safety and Quality in Health Care, 2013a, p. 10)
Open disclosure	An open discussion with a patient about an incident that resulted in harm to a patient while they were receiving health care (Australian Commission for Safety and Quality in Health Care, 2013a, p. 3). This term includes a process of providing an apology. For the purposes of this research the term 'disclosure' refers to the acknowledgment of an error
Safety climate	Shared perceptions, beliefs, values, norms and practices that achieves patient safety (Morello et al., 2013).
Key terms (method)	
Configurational	A group of methods used to study cases by considering configurations of

comparative method (CCM)	the presence (or absence) of conditions of interest and determines those which may be causal for the presence (or absence) of an outcome (Ragin & Amoroso, 2011). Also known as *set-theoretic methods* (Schneider & Wagemann, 2012).
Crisp set qualitative comparative analysis (csQCA) **Fuzzy set qualitative comparative analysis (fsQCA)**	The two most commonly used configurational comparative methods. The first (csQCA) provides for comparison of dichotomised of set membership (the condition or outcome is either present or absent) (Greckhamer, Misangyi, & Fiss, 2013; Ragin, 2009; Schneider & Wagemann, 2012). The latter (fsQCA) applies calibration to set membership. That is, set membership is allocated by degrees of membership rather than the presence or absence of the condition or outcome. More details of each of these may be found in Chapter 4.
Condition	Something that may affect an outcome (Rihoux & Ragin, 2009) or may explain it (Schneider & Wagemann, 2012)
Outcome	The main focus of a study, the variable to be explained by conditions (Rihoux & Ragin, 2009) or the phenomenon of interest (Schneider & Wagemann, 2012).
Case	Cases may be a theoretical construct or identified through empirical units (Ragin, 1992). Ultimately, it is important for a researcher to clearly indicate what a case is of (Luck, Jackson, & Usher, 2006).
Contradiction	Cases exhibiting identical configurations of conditions but where the outcome is different (Berg-Schlosser, De Meur, Rihoux, & Ragin, 2009; Ragin, 2009)
Conjunctural causality	The intersection of more than one factor (that is a configuration of conditions) leading to an outcome (Ragin, 1987)
Equifinality	The possibility that more than one configuration (that is alternative configurations of the same conditions) may also lead to the same outcome (Schneider & Wagemann, 2012).

Two sets of key terms are presented in Table 1-1. The first of these relates to the research content, namely error reporting, disclosure and safety climate while the second group of terms refer to the research design.

1.3 Identifying the research problem

The lack of research regarding safety climate and the reporting and disclosure of error amongst nurses in rural clinical settings has been determined through consideration of available literature. While some of the literature is referred to here, more detail is provided in Chapter 2.

In addition, CCM requires that theoretical knowledge is used to inform the design of any research. This is discussed further in Chapters 3 and 4.

Some background regarding the problems associated with error and patient safety was provided earlier in this chapter (Section 1.1). Error is costly and impacts upon patients as well as clinicians. It is evident from some very public examples that the issue remains a prominent one for the health system.

The uniqueness of error management within rural settings has been acknowledged (Australian Commission for Safety and Quality in Health Care, 2012b; Institute of Medicine, 2005). Yet, despite acknowledgment of the difficulties that rural hospitals face in terms of isolation and financial limitations there is little research available in this area (Thornlow, 2008).

Therefore rural clinical settings were used for this research. Restricting the research to the Tasmanian context ensured a single heath system was involved.

Error, in particular medication error, is not limited to the hospital setting. Studies have identified that aged care, mental health (Haw, Stubbs, & Dickens, 2014) and community settings (Easton, Morgan, & Williamson, 2009) are also areas where medication error occurs. No studies were found that involved a variety of settings within the rural context. Due to its broad incidence, medication error was the focus of this research.

Nurses are actively involved in medication management (Choo, Hutchinson, & Bucknall, 2010). Although there are studies that consider the role of nurses in medication management and medication error, few are available that relate to the rural context. Therefore research amongst nurses has been undertaken for this research.

Safety climate has been found to differ across different settings and amongst different roles (Braithwaite et al., 2009; Castle & Sonon, 2006; Vlayen, Hellings, Claes, Peleman, & Schrooten, 2011). While there are suggestions of links between safety climate and error (Colla, Bracken, Kinney, & Weeks, 2005) others suggest there may not be (Groves, 2014), indicating the area is one with a degree of complexity. One study in rural settings found safety climate changed over time when a medication error reporting system was introduced (Jones, Skinner, Xu, Sun, & Mueller, 2008). Safety climate was therefore considered an important element for this research.

The subject matter of this research was therefore determined as safety climate, views of reporting and views of disclosure. Rural clinical settings were determined as the context with the participants being nurses working in rural clinical settings in Tasmania.

1.4 Research aim and questions

The aim of this research is to *describe the complexity of safety climate of nurses working in rural clinical settings.*

The principle research question of this research is *how is safety climate related to views of reporting and disclosure of medication error amongst nurses working in rural clinical settings?*

This question is informed by five sub-questions which are:

1. *What level of reporting and disclosure of different severity of a hypothetical medication error do nurses in rural clinical settings think is occurring?*

2. *What is the nature of workplace safety climate amongst nurses in these settings?*

3. *What is the relationship between workplace safety climate amongst nurses in rural clinical settings and their views of reporting/disclosure of a hypothetical medication error?*

4. *How is the understanding of the relationship between workplace safety climate and views of reporting medication error changed through the use of a configurational comparative method?*

5. *What does this mean for the management of medication error?*

The first two of these research sub-questions relate to the *conditions* and *outcomes* of this research. The third compares the relationship between the two. The fourth and fifth sub-questions make reference to the method used and the overall key finding of this research.

1.5 An overview of the research approach

This research uses a configurational comparative method (CCM) within a framework of health care as a complex system. Configurational comparative methods are a case-based approach to research, primarily used within the social and political science, although potential use in other areas, including health, have been noted (Bell, 2007; Ragin, 1999a, 1999b; Rihoux, Ragin, Yamasaki, & Bol, 2009).

The research design applied for these methods centres upon the concept of *conjunctural causality* and *equifinality* from studying configurations of the presence or absence of *conditions* for the presence or absence of an *outcome.* Although foundations of CCM are from fuzzy set theory, they are to all intents and purposes *qualitative*.

That is, the methods identify combinations of causal conditions which may impact an outcome. The data are handled in sets. Combinations of the presence or absence of a condition are compared to the outcome (or non-outcome) of interest.

The theoretical framework of this research is based upon complexity (Lewin, 1999) and in particular a view of how knowledge is generated in a complex health care system (Martin & Félix-Bortolotti, 2010). This framework regards health care as a system made up of sub-systems in which knowledge is obtained through *evidence* and *sense-making.* The former is based upon the concept of knowledge as *truth* and the latter on knowledge as *understanding* (Bennett et al., 2005).

Evidence is informed through *simple/complicated* systems using research which is largely based upon cause-and-effect science reflecting the nature of evidence based medicine (EBM) (Martin & Félix-Bortolotti, 2010). In contrast, *complex/chaotic* systems are underpinned by *complexity* that is better understood through more *inductive* approaches to research.

In order to research complexity appropriate methods are required. Configurational comparative methods (CCM) apply fuzzy set theory to analysis that considers diversity of cause, or *conjunctural causality* (Ragin, 1987; Ragin & Amoroso, 2011). That is, there may be more than one condition required to be present in order to *cause* an outcome. In addition, there may be more than one pathway or combination of conditions that may be causal. This is referred to as *equifinality* (Schneider & Wagemann, 2012).

As these methods are underpinned by the existence of complexity, the approach was considered appropriate for this research.

1.6 Significance and scope of the research

The subject matter of this research is safety climate and views of reporting and disclosure of a hypothetical medication error amongst nurses in rural clinical settings. The process of undertaking the research was use of CCM within a framework of health care as a complex system.

Findings relate to each of these and encompass three areas. These are the complexity of safety climate in rural clinical settings, the implications for *resilience* and the need to reframe error management as an element for the delivery of safe patient care.

The research contributes to knowledge in three areas. Firstly, it extends current knowledge relating to the complexity of error reporting, disclosure and safety climate amongst nurses in rural clinical settings. This is achieved through both a variable and case-based analysis of the data obtained from an online questionnaire.

Findings of this research reflect those of other studies, particularly in relation to workplace setting and work role.

Traditional approaches to safety include the measurement of error. It is regarded that this way of doing things identifies what is not safe rather than what is. This is termed a *Safety I* approach and what is needed is *Safety II* or more focus on the things that are done well (Hollnagel, 2014). Where organisations continually do things well it is regarded as *resilience.*

The second contribution this research makes is in relation to the understanding of the relationship between safety climate and views of reporting and disclosure of error. This finding is informed through the research design which regarded health care as a complex system with knowledge generation acquired from both *evidence* and *sense-making.* Variable-based results reflect those of other studies but the inclusion of case-based results obtained through use of CCM allows for understanding to be extended to the impact the relationship has upon each individual nurse. It is possible that some nurses are *resilient* to safety climate. That is, they are capable of delivery of safe patient care regardless of the nature of the safety climate of their workplace.

Finally, this research contributes to knowledge for the management of medications. Rather than view safety climate as an intervention to improve medication management, including error reporting and disclosure, error management should be viewed as an intervention required for safe patient care.

Both the subject matter and design of this research determine its scope. The research was conducted amongst nurses working in rural clinical settings in Tasmania. Specifically, the research focused upon safety climate and views of reporting and disclosure of a hypothetical medication error. The method used for the research was a configurational comparative method applying fuzzy set qualitative analysis (*fsQCA*).

It is therefore expected that the primary audience for this research will be those interested in patient safety, particularly those concerned with error management and medication error. However, as this research has also used a CCM, it is recognised that some of the readership may include those interested purely in the research design and method, without a particular interest in the subject matter.

1.7 An outline of the thesis

Having introduced the research the thesis will now be outlined. Each of the following chapters contains further detail regarding this research.

Chapter 2 is presented in two parts. Part I provides the background to the research including the importance of error management and error disclosure. The context of the research is also introduced, including the non-static nature of the health care system. An overview of health services in Tasmania, the location of this research, is provided.

The second part of Chapter 2 explores the literature in relation to error reporting, error disclosure and safety climate. Areas of difference that have been noted in previous studies are outlined, including differences between rates of error reporting and disclosure as well as differences in relation to workplace setting, work role and various other factors. Research related to safety climate and teamwork is also presented, again noting differences relating to workplace setting and work role. Literature relating to the relationship between safety climate and error reporting and disclosure is also examined in this chapter

Chapter 2 concludes with the development of the aim and main research question that is explored in this research. The first three research sub-questions informing the main research question and aim are also presented.

In Chapter 3 the contrast between evidence based medicine (EBM) and complexity science is presented. This contrast is then explored within a framework of health care as a complex system, thereby forming the theoretical framework for this research. Knowledge is discussed in terms of an *absolute truth* as compared with an *understanding* which is mirrored in the framework as knowledge generation based on *evidence* and *sense-making.* Configurational comparative methods (CCM) are introduced as a means of researching the complexity of health care. Two further research sub-questions are presented at the conclusion of this chapter.

The method is outlined in Chapter 4. This includes the research design for use of CCM. This design is based upon the *funnel of complexity* which consists of the three phases of before, during and after *the analytic moment.*

The first phase consists of using existing theoretical knowledge to inform this design, including data collection and data analysis. This is outlined in detail in Chapter 4 in relation to the development of a questionnaire based upon existing available tools.

A variable-based approach to analysis (inferential statistics) has been used alongside the case-based analysis of fuzzy set qualitative comparative analysis *(fsQCA).* The first is undertaken in the *before the analytic moment* phase as some results inform the analysis using *fsQCA.* Details of the variable-based analysis are outlined in detail.

This is followed by details of the analysis using *fsQCA.* The analysis proper is the second phase, termed *during the analytic moment.* Once this has been outlined an overview of how the *fsQCA* results are presented is provided.

Chapter 5 provides the results in two separate parts. Variable-based results are presented in Part I and the case-based results are included in Part II.

Variable results include frequency data relating to the demographic data allowing for an overview of the sample to be provided. This includes, where possible, assessment of sample representativeness.

Other results include those relating to safety climate and the identification of factors of teamwork and safety climate through principal components analysis. These form the basis of the *conditions* for analysis with *fsQCA.*

The final chapter, Chapter 6, interprets the results. This represents the final phase of the *funnel of complexity* or the *after the analytic moment.* This phase requires results to be interpreted in respect to the theoretical knowledge that underpinned the research design.

Both variable and case-based results are interpreted in this fashion, with consideration also given to each of the research sub-questions as well as to the overall main research question and the research aim.

The limitations of the research are also discussed in Chapter 6. These are outlined in relation to research design, analysis and generalisability of the results. The chapter concludes with a discussion of the implications of the research findings upon future practice along with suggestions for future research.

The need for improvements in patient safety and health systems reform have been referred to as a "quality chasm" (Institute of Medicine, 2001). The following chapters outline research that has been undertaken with the aim to *describe the complexity of safety climate of nurses working in rural clinical settings.* In doing so it makes a contribution to narrowing the quality chasm.

2 The complex nature of health care error

Patient harm resulting from human error remains an ongoing challenge for health care. The issue is important to consumers, clinicians, managers and government. Despite almost a quarter of a century of work aimed at improvement, patient safety remains an ongoing matter of both public and professional debate.

Health care services form a complex system. Understanding and managing error within that complex system is important for providing safe patient care. This, along with the impact of safety culture, is the subject of this research.

The key role of this chapter is to provide an overview of both the context and literature and outline how each of these informed the development of the research. The chapter is divided into two parts with the first of these providing an overview of the background of patient safety and provides the context for the research. The second part discusses how the available literature has informed the research aim and research question.

The complex nature of health care is outlined in Part I. The global context of patient safety is presented followed by background in relation to the Australian context. Information about health services and recent developments in Tasmania is then provided.

Following this the complexities that evolve from defining *error* are discussed with specific consideration given to error and the disclosure of error in health care settings. Some background is also provided about current law and policy in relation to these matters in the Australian context.

Approaches to patient safety and error management are then presented introducing the concept of *resilience engineering.* The management of error health care is outlined including discussion of the differences found when comparing health care compared to other industries. Part I concludes with an overview of medication error within the Australian context.

Part II provides detail of current knowledge of error reporting and error disclosure. It commences with an examination of the publications available from a recent search of the literature relating to error reporting and disclosure. This is followed by a summary of the literature relating to error reporting and disclosure and the differences that exist based upon workplace setting, work role and other factors. At the end of Part II is a discussion of safety climate that focuses on how differences have been found in these same areas in relation to variations in safety climate.

The chapter concludes with an explanation of how the literature has informed the research. From this discussion the development of the research aim and research question are outlined. Three research sub-questions, necessary for informing the overall research question, will also be presented. A constant theme throughout both parts of the chapter is that health care delivery, error reporting and disclosure and safety climate are areas that are extremely complex.

Part I: Background and context of the research

Before examining the literature relating to error, disclosure and safety climate in detail it is important to provide some background and context to the research. Patient safety is important within health care settings and there have been several key developments over a number of years that have informed the management of error today.

In addition, there has been a large amount of change to the way that health care is delivered and such reform means the health system is constantly changing. The recent changes in the Australian and Tasmanian context are noted in this part of the chapter.

Definitions of *error* and *disclosure* are then provided followed with an explanation of why they are important issues. This is followed by an overview of how health care differs from other industries in relation to error management.

Approaches to error management are then outlined, including an introduction to the concept of *resilience engineering* (Qureshi, 2007). Detail regarding the specific issue of the management of medication error, a common source of error in health care, concludes this Part I.

2.1 Global context

In 1991 the *Harvard Medical Practice Study* (HMPS) estimated that 3.7% of hospital admissions in the United States (US) resulted in an adverse event (Brennan et al., 1991). This study is credited with leading to both the establishment of a set of standards to measure such events and laying the groundwork for policy discussion on patient safety in a number of countries (Baker, 2004). Another important, but less widely noted element of this same study was that many acts assessed as negligent resulted in either minimal or minor injury to the patient (Brennan et al., 1991).

Following the HMPS the Institute of Medicine (IOM) released a series of reports relating to human error. The most prominent of these was *To Err is Human* (Kohn et al., 2000). Considered a landmark in health care safety and quality this report urged for the recognition that error occurs as a result of human factors recognising it as an inevitable occurrence in clinical environments. It argued for a greater focus on a systems approach to dealing with error.

Studies similar to HMPS have been undertaken in many other countries, including the UK (Vincent, Neale, & Woloshynowych, 2001), Australia (Wilson et al., 1995), New Zealand (Davis et al., 2001) and Canada (Baker et al., 2004). Results from these studies found that between 3.7% and 16.6% of hospital admissions suffered an adverse event. Whilst such data suggests there is a widespread problem, there are also public examples of serious organisational failure in regards to patient safety.

For example, in the United Kingdom (UK) in 2001 the events of the Bristol Infirmary became public. Investigations following the deaths of more than 50 children who had undergone cardiac surgery found failures in the audit processes and emphasised the need for strong clinical leadership (Walshe & Offen, 2001).

Another UK example is that of *Winterbourne View,* a private hospital offering treatment and rehabilitation for people with a learning disability. Despite regulatory oversight, poor care in this facility went undetected and it was not until families blew the whistle publicly that issues such as the excessive use of physical restraints were acknowledged. Patients were subject to what has been described as '*horrific and sustained abuse'* (Department of Health, 2012, p16). Following legal proceedings six staff were imprisoned for their criminal actions.

The release of the *Report of the Mid Staffordshire NHS Foundation Trust Public Enquiry* in February 2013 (Francis, 2013) provided yet another reminder of the importance of appropriate error management within health care settings and how things can go terribly wrong. The report was undertaken to investigate why the rust had such a high mortality rate.

The release of this report occurred some 25 years after the acknowledgment that error within health settings was a problem. Amongst the findings was the identification that Mid Staffordshire Trust staff had accepted low standards of care (Francis, 2013). It was not only that error was unreported, but when concerns were raised those in positions of responsibility failed to act. This was not limited to the hospital as the academic sector also came under fire for failing to acknowledge and appropriately deal with safety concerns raised by students.

Although this report noted that the benefit of hindsight was mentioned by several of those who gave evidence, others have noted the importance that culture played in this situation (Reason, 2013). Other issues of concern raised from the report include the impact that a focus on cost-cutting had over patient care (Francis, 2013).

2.2 Australian context

The *Quality in Australian Healthcare Study* was published in 1995. This study found 16.6% of hospital admissions resulted in an adverse event (Wilson et al., 1995). Following its release the Australian Council for Quality in Health was formed in 2000 and five years later agreement was reached on the formation of a commission (Barraclough & Birch, 2006). Since its inception *the Australian Commission for Safety and Quality in Health Care* (ACSQH) has produced numerous supports for safety and quality including a set of standards that are now mandatory for hospital accreditation (Australian Commission for Safety and Quality in Health Care, 2011a). One of the standards (Standard 4) relates to medication management, indicating the importance of this issue for patient safety. The ACSQHC has also produced a framework for open disclosure (Australian Commission for Safety and Quality in Health Care, 2013a) with a requirement for an open disclosure process conforming to this framework now a requirement for hospital accreditation in Australia (Australian Commission for Safety and Quality in Health Care, 2011a).

Australia also has examples of serious incidents relating to patient safety with a major enquiry having been undertaken in New South Wales (NSW) following several incidents at Sydney's Royal North Shore Hospital. The *Garling Enquiry* found ongoing issues in relation to culture and made several recommendations including the need for clinicians to be the drivers for change (Skinner et al., 2009).

A further example from Australia is the *Queensland Bundaberg Hospital Enquiry* (Queensland Health, 2005). This enquiry was instigated after a nurse blew the whistle on events surrounding the work of surgeon Dr Jayant Patel. The concern from this particular case of system failure is that staff raised issues internally but those calls were not investigated or acted upon. It was only when details were raised within the Queensland Parliament under parliamentary privilege that any action was taken. Dr Patel was eventually charged and whilst the following trial found him guilty he was later retried and acquitted (Australian Associated Press, 2013).

Major incidents are not purely the domain of hospital settings. The aged care sector in Australia has also had high-profile examples of poor patient care. In 2000 it was found that residents of the Riverside Nursing Home in Victoria had been bathed in kerosene as a treatment for scabies (Cauchi, 2002).

A later senate enquiry released in 2005 noted there were problems with nursing homes, the aged care complaints process and accreditation and made 51 recommendations (Commonwealth of Australia, 2005). Nursing home accreditation is now undertaken by the *Australian Aged Care Quality Agency* and nursing homes that do not achieve accreditation are not able to receive Commonwealth subsidy payments (Australian Aged Care Quality Agency 2015).

These incidents need to be put into context. A recent report into noted with respect to *Safe Care Measures* Australia ranks third behind the United Kingdom (UK) and France with the US ranking eleventh (Davis, Stremikis, Squires, & Schoen, 2014). In addition Australia operates accreditation systems for hospitals, aged care and general practice (Hinchcliff et al., 2012). Although the approaches are separate, a recent publication has identified that a hybrid model consisting of a focus on both regulatory compliance and continuous improvement have evolved across the different sectors (Greenfield, Greenfield, Hinchcliff, Hogden, Mumford, Debono, Pawsey, Westbrooke & Braithwaite, 2015).

However, despite these systems and rankings, the previously referred to enquiries have identified failures within health care organisations in terms of how error is dealt with as well as failures to understand what constitutes the safe delivery of care. Approaches to error management will be discussed at a later stage in this chapter. Prior to this an overview of the health system in Tasmania will be presented.

2.3 Tasmanian context

Tasmania is the small island state of Australia. It has a population of approximately half a million (Department of Treasury and Finance, 2015) and a health system that is constantly challenged. The population is decentralised and largely rural.

A common approach to identifying the rural location of services is the Australian Standard Geographical Classification (ASGC) Remoteness Area (RA) (Australian Government, 2010). This classification defines locality as major cities (RA-1), inner regional (RA-2), outer regional (RA-3), remote (RA-4) and very remote (RA-5). Tasmania has no major cities so the state has health services in the ASGC-RA 2-5 classifications. The two inner regional areas are located around the capital city, Hobart and the northern city of Launceston. As the majority of the state is considered outer regional, remote or very remote there is an opportunity to research rural clinical settings within a single health system.

Prior to the reforms to the Australian health system the state's Department of Health and Human Services (DHHS) operated three regional health areas in the South, North, and North West. A major health plan released in May 2007 identified a variety of health services across the state (Department of Health and Human Services, 2007). These services include four public hospitals (Royal Hobart Hospital, Launceston General Hospital, North West Regional Hospital and Mersey Community Hospital) and private hospitals in the south, north and north-west of the state. There were also several rural hospitals (some of which operate multi-purpose services including both acute and aged care beds) and community nursing services (both public and private sector), residential aged care facilities, mental health services and disability services group homes. General practitioners operate in many townships with some practices located within or near to a local hospital.

The health reforms implemented following the election of the Rudd Government in 2007 saw the formation of health organisations that were contracted by state health departments to deliver health care services. Tasmania had three of these although the current federal government reforms have resulted in a merging of the initial three health organisations formed to just one—the Tasmanian Health Organisation (THO) (Department of Health and Human Services, 2015).

This is in addition to the Tasmanian Medicare Local (TML is the organisation which has responsibility for working alongside the THO to improve service delivery and outcomes in primary care). From 1 July 2015 this entity will become a *Primary Health Network* as part of reforms by the current federal government (Tasmania Medicare Local Tasmania, 2015).

In 2011 the Tasmanian government announced a restructure and staffing cuts as part of budgetary reform with further budgetary tightening undertaken during 2012. The current state government is also undertaking restructuring with the recent release of a consultation white paper (Department of Health and Human Services, 2015).

This demonstrates how health care operates within a political environment where change occurs on a regular basis and where the health system does not remaining static over time. Whilst the detail of the timing of this research is outlined in the methods chapter (Section 4.2.7) it should be noted here that this research was undertaken within the context of ongoing change.

It is within the context of constant change that error management occurs. The notion of a changing environment within a complex health system will be discussed further in the following chapter.

2.4 Defining error

It is expected that incidents within clinical settings, including those resulting from error, are managed and such management includes identification, reporting and analysis to improve patient safety systems (Australian Commission for Safety and Quality in Health Care, 2011). The term reporting is used in this research to indicate the formal notification of error as part of such incident management.

In order to discuss error further it is necessary to define it. Error has been defined as *"all those occasions in which a planned sequence of mental or physical activities fails to achieve its desired goal without the intervention of some chance agency"*(Reason, 2013, p. 10).

The subject of error becomes more complex when consideration is given as to how it occurs. There are two pathways that may lead to an error (Reason, 2013). The first is that the plan may be appropriate but it is not properly executed (for example, prescribing a medication that is then administered at the wrong dose) and the second is that the plan itself may be inadequate so even when executed the desired outcome is not achieved (such as prescribing an antibiotic for a viral illness). The second situation involves a greater level of complexity and it is therefore often more difficult to detect resulting errors so they frequently remain undetected for some time (Reason, 2013).

Error has also been described as *active* or *latent*. An *active* error indicates the error effect is immediate whilst a *latent* error is one that is present for some time and can spread through an organisation before the impact is felt (Reason, 1997). Active error usually surfaces within the front-line workforce and is the result of human factors often equating to the poor execution of a plan (Reason, 1997). By contrast latent error originates within the upper levels of an organisation or government agency so it is more likely to be the result organisational factors and the absence of an adequate plan being in place.

Within health care numerous definitions of error exist. One review found that whilst 45 studies had a generic definition of medication error there were 26 different forms of wording which is problematic as the lack of consistency makes comparing studies difficult (Lisby, Nielsen, Brock, & Mainz, 2010).

The definitions used for this research are specific to the research context where possible. The Australian Commission for Safety and Quality in Health Care (ACSQHC) has defined error as *"failure to carry out a planned action as intended or application of an incorrect plan"* (Australian Commission for Safety and Quality in Health Care, 2013a, p. 2). Error is the result of a differentiation of that which may be due to commission (by doing the wrong thing) or by omission (failing to do the right thing).

An error may or may not result in harm which is an "*impairment of structure or function of the body and/or any deleterious effect arising therefrom, including disease, injury, suffering, disability and death"* (Australian Commission for Safety and Quality in Health Care, 2013a, p. 2). Such harm may be of a physical, social or psychological nature.

An "*adverse event* is *an incident in which harm resulted to a person receiving health care"* (Australian Commission for Safety and Quality in Health Care, 2013a, p. 2). Not all adverse events are the result of foreseeable preventable error (Thomas & Petersen, 2003). Where an incident occurs that "*does not cause harm but had the potential to do so"* is referred to as a "*near miss*" (Australian Commission for Safety and Quality in Health Care, 2013a, p. 3). Where an error occurs that reaches the patient but does not cause harm it is referred to as a *“no harm incident”* (Australian Commission for Safety and Quality in Health Care, 2013a, p2). However, it is also arguable that such incidents are also *“near miss”.* Therefore the term “near miss” has been used in reference to both instances for this research.

Medication error is the term used for “*any preventable event that may cause or lead to inappropriate medication use or patient harm”* (Australian Commission for Safety and Quality in Health Care, 2013a, p. 10). The medication may be in the control of a health care professional, patient or consumer.

This compares with an *adverse medicines event* or *adverse drug reaction.* An *adverse medicines event* occurs when the cause of harm is the result:

> *…from the medicine itself (adverse drug reaction) and the potential or actual patient harm that comes from errors or systems failures associated with the preparation, prescribing, dispensing, distribution or administration of medicines (medication incident).* (Australian Commission for Safety and Quality in Health Care, 2011a, p. 7).

The term *adverse drug reaction* applies to:

> *…a drug response that is noxious and unintended, and which occurs at doses normally used or tested in humans for the prophylaxis, diagnosis or therapy of disease, or for the modification of physiological function* (Australian Commission for Safety and Quality in Health Care, 2011a, p. 7).

Different definitions for different types of error reflect the complexity of error and subsequent error management. Similar complexity exists when considering definitions for error disclosure.

2.5 Defining error disclosure

Clinicians involved in incidents where patients are harmed do not go unaffected from the experience. In addition, when a practitioner makes an error work colleagues are often affected through witnessing what they go through (Hall & Scott, 2012; Wu, 2000; Wu & Steckelberg, 2012).

The term *second victims* is used to describe the suffering experienced by clinicians involved in a patient safety event (Nelson & Beyea, 2009). Clinicians often suffer similar emotions to the *first victims* (the patient and their family) with some health care workers leaving the profession and a small few committing suicide (Wu & Steckelberg, 2012). One study found that one in seven staff who had experienced a patient safety event within a twelve-month period had suffered anxiety, depression or had doubts about their ability to do their job well (Hall & Scott, 2012).

Associated with this is the issue of being open with patients and/or their families if an error occurs. With a growing impetus to incorporate disclosure as an essential part of managing adverse events there is also a need to ensure that clinicians are supported as well as the patient and their families. (Wu & Steckelberg, 2012). Despite fears of litigation (Studdert & Richardson, 2010; Haw et al., 2014) it has been identified that the risk of this occurring is reduced if there is openness when an error occurs (Gallagher et al., 2007).

Just as there are multiple definitions for the term *error* there is also difference associated with the term *disclosure.* This, along with a brief overview of the law, will now be considered.

A published review of the literature on disclosure found that policies in relation to dealing with adverse events with openness used a variety of terms such as *duty of candour, full-disclosure* and *disclosure of harmful errors* (Allen & Munro, 2008). Although terminology and language differs, the policies and definitions work towards a common goal of dealing with a patient and/or their family when an adverse event occurs.

A more recent systematic review found a gap between the ideal practice of disclosure and what really occurs (O'Connor, Coates, Yardley, & Wu, 2010). It was also noted that the bulk of research on disclosure is related to the experience of physicians despite health care being delivered by multi-disciplinary teams.

For this research use of the term *open disclosure* is defined as "*an open discussion with a patient about an incident(s) that resulted in harm to that patient while they were receiving health care"* (Australian Commission for Safety and Quality in Health Care, 2013a, p. 4). The *Australian Open Disclosure Framework* outlines that for open disclosure to occur there should be an apology, provision of the facts regarding the events leading to the harm and an explanation of what will be done to manage the situation along with information about what is being done to ensure a similar situation does not arise again. The patient also needs to be given an opportunity to put forward their own experience. This process may occur over more than one meeting.

For the purposes of this research the term *open disclosure* will be used when referring specifically to this definition as provided within the *Australian Open Disclosure Framework* (Australian Commission for Safety and Quality in Health Care, 2013a). The term *disclosure* will be used in reference to the acknowledgment to a patient and/or their family that an error has occurred.

In Australia a nurse is mandated to report if he or she has any serious concerns relating to care delivery patients may have received from other health care workers (Australian Health Practitioner Regulation Agency, 2010). They also have to balance their duty of care to the patient (also legally mandated) with their duty to the team, their organisation and their personal interests (Harrison et al., 2014).

The open disclosure of error is also required as part of the hospital accreditation process. Standard 1.16 of the National Standards requires a program is in place that is based upon the national open disclosure standard (Australian Commission for Safety and Quality in Health Care, 2011a; Australian Commission for Safety and Quality in Health Care, 2013a).

Within the Australian context it has been noted the laws associated with disclosure have not been developed with disclosure in mind and they have been described as offering “weak” protection for clinicians (Studdert & Richardson, 2010). It is not only a fear of medico-legal consequences but also a lack of education and training in the skills required to undertake the process that is a barrier (Studdert & Richardson, 2010).

An example of this is apology laws. Clinicians in some states who apologise for an error are protected from the use of that apology in any subsequent litigation. Other states, of which Tasmania is included, either do not offer this protection or any admission of fault is excluded from what constitutes an apology (Australian Commission for Safety and Quality in Health Care, 2012a; Studdert & Richardson, 2010). As a result there is a conflict between what the system expects by way of protecting the public compared to what is offered with respect to the protection of clinicians.

There are some who argue that protection of the public does not go far enough and that the duty to disclose should be mandatory. A case heard in the European Court of Human Rights found that there was no statutory requirement for medical professionals to inform patients when errors occur (Powell, 2014). This has sparked debate around the need for mandated duty of candour (Birks, 2014; Francis, 2014; Powell, 2014). A legislative requirement such as this would put the accountability upon the individual and it is not clear if such an approach would be effective. There are arguments that the accountability for error disclosure should be maintained as an organisational a systems focus rather than placing responsibility for disclosure at the level of the individual. (Harrison et al., 2014).

It is issues such as these that create tension between what is expected of clinicians and what they are able to undertake in the day-to-day reality of practice. This underlying complexity makes it difficult to ensure that error is always appropriately dealt with within the health care system.

2.6 Approaches to patient safety

There are numerous approaches to patient safety and error management. Perhaps the most well-known is the *Swiss Cheese Model* outlined by James Reason (Reason, 1997). This model is based upon a linear view of error whereby a series of barriers and defences are put in place to prevent error. These barriers are regarded as being full of holes and when the holes line up an error trajectory occurs resulting in organisational disaster. Reason himself has since been critical of the limitations of this approach recognising the work of other error theorists (Reason, 2013).

Another error theorist has criticised the practice of safety models being developed through the use of average data from large data sets. This leads to the hiding of variability and conclusions drawn from large samples to inform small to medium businesses which is where the majority of workplace injury occurs (Townsend, 2013). He argues for a greater focus on qualitative research methods to inform safety theory.

A review of approaches to accident modelling was published in 2007. This review acknowledges Reason’s work but argues in regards to the existence of latent errors that systems are extremely dynamic and complex (Qureshi, 2007). Qureshi summarises a series of other accident models that focus on complex socio-technical systems suggesting that *resilience engineering* may be a new paradigm for safety management (Qureshi, 2007)

This concept is based upon organisations behaving as complex entities where success in safety management is the result of being able to adapt to that very complexity and the changing nature of risk (Qureshi, 2007). Safety is traditionally seen as where things do not go wrong, yet it is measured by its absence (Hollnagel, 2014). That is, when an incidence occurs, or could occur, there is a focus on cause-effect and prevention is undertaken through management of the cause. Over time, the focus on the causal elements of significant incidents has meant that there is less focus on when things go right.

Hollnagel argues, that if the rate of incident occurrence is 1 out of 10 000 then in 9999 instances the expected and safe outcome eventuates (Hollnagel, 2014). He defines the reactive approach of avoidance of things going wrong as *Safety I* and presents the alternative *Safety II* approach of ensuring things go right. The latter recognises the ability of workers to adjust to the conditions surrounding them and to recognise when situations deviate from what is normal.

Health care has been acknowledged as a complex adaptive system (Martin & Félix-Bortolotti, 2010) where the focus of cause and effect, single interventions may lead to "unintended consequences" (Martin & Sturmberg, 2009). This will be explored further in the next chapter, particularly in relation to research.

The remainder of this chapter will be devoted to consideration of complexity in the management of medications.

2.7 The management of error and disclosure in health care

The management of error is important to consumers, clinicians and governments. Consumers may be harmed as a result of error, which is an obvious concern. As error can lead to increased health care costs it becomes a concern to governments as well. As indicated earlier in this chapter (Section 2.5), clinicians are also concerned with error in that they do not wish to harm others, but when this occurs they may also suffer themselves, as may their colleagues.

As error may lead to harm it may also lead to increases in the cost of health care delivery. The *To Err is Human* report estimated that the cost resulting from error in the hospital system in the US is between US$17—29 billion annually, of which half is health care costs (Kohn et al., 2000).   In Australia during 2012—2013 the rate of adverse event amongst hospital separations was 5.5 per 100 separations (Australian Institute of Health and Welfare, 2014). Reducing the rate of harm reduces the additional costs to the health system making error prevention in the health care sector a concern for government.

When dealing with error management it is important to spend hard dollars to make savings, but savings are often indirect and therefore difficult to measure (Barach & Small, 2000). The development of national standards for accreditation of Australian Hospitals (Australian Commission for Safety and Quality in Health Care, 2011a) may assist with this, although it may be some time before any impact can be assessed. Despite acknowledgment that accreditors are able to encourage cultural change (O'Leary, 2000) it remains to be seen what that change may be with respect to error management.

Reference to *culture* has occurred several times in this chapter including the findings of enquiries (Francis, 2013; Skinner et al., 2009) as well as need for appropriate culture to ensure disclosure occurs. More detailed discussion of culture is provided later in this chapter (Section 2.15). Prior to this, the differences relating to health care will be explored followed by an outline of medication management and error.

2.7.1 How health care is different to other industries

Three key elements are seen as being present in all disasters. These are the presence of contributing factors well before the disaster, putting systems of barriers and defences in place prior to prevent such disasters and, the presence of unforeseen latent conditions that defeat these defences (Reason, 2013).

There are elements of the health care system that differ to other industries in relation to error. They are succinctly outlined in a recent publication by James Reason (Reason, 2013). The key differences he highlights relate to the complexity of care delivery, complexity of patient illness and needs, and the manner in which error is investigated.

Firstly, the context in which health care is delivered is complex. This has already been noted with reference to the health system in Tasmania (Section 2.3). Health care delivery is hands-on, diverse and so is the equipment. One patient will be cared for by several clinicians and support staff whilst at the same time those staff will have care responsibilities for many other patients. This complexity of care delivery results in a risk of error occurring.

Secondly, the care is delivered to patients who have very complex needs. The more acute the setting, the more acute the patient illness and therefore the more acute the patient needs. This makes for potential risk but can also result in health care professionals bypassing various safeguards in order to save time. The sum of these factors is an increased risk of error occurring.

Finally, when an error occurs it is usually investigated at the local level. In other industries an adverse event is often quite public, hence the investigation is public and the findings are shared. Health care error is not so public and usually this means that the local investigation does not publicly share the lessons learned. Information is not disseminated which further enhances the risk of error occurring, perhaps not in the original setting but somewhere else.

All of the above is then compounded further through the training of health professionals. The emphasis on training to perfection results in an expectation that things must always go right. So whilst the abovementioned enquiries may seem disturbing, when considering the environment and expectations of clinical practice, it is not surprising they have been required as a result of error not always dealt with openly and swiftly.

2.8 Medication management and error

Medication error is a key issue amongst health settings in Australia. It is estimated that approximately 2—3% of hospital admissions are related to an adverse event associated with a medication costing the Australian health system some $1.2 billion annually (Australian Commission for Safety and Quality in Health Care, 2013a). Medication error within the community setting has also been identified as a problem (Easton et al., 2009) particularly amongst those taking numerous medications (Gilbert, Roughead, Beilby, Mott, & Barratt, 2002).

There are numerous barriers and defences that have been put in place in Australia with the aim of preventing medication error. Recommendations for prevention include not using hazardous abbreviations, greater involvement of clinical pharmacists, medication reconciliation and use of technology (Australian Commission for Safety and Quality in Health Care, 2013b).

In relation to future research several areas have been highlighted. Included in these are the prioritisation of interventions to improve post-discharge transitions, measures to encourage a culture of patient engagement, and the use of human factors engineering and ergonomics in the design of health care practices (Australian Commission for Safety and Quality in Health Care, 2013b).

Patient involvement in the management of medications is particularly important. Studies have identified prescribing, dispensing and administration of medication as areas where medication error may occur (Australian Commission for Safety and Quality in Health Care, 2013b). Whilst these three areas are regarded as elements where interventions may be applied to reduce the risk of a medication error occurring, the patient is considered the final point at which an error may be prevented (Elliott & Liu, 2010).

Medication safety is one of the standards required for hospital accreditation in Australia (Australian Commission for Safety and Quality in Health Care, 2011a). This standard (Standard 4) contains requirements for governance and systems for medication safety, documentation of patient information, medication management processes, continuity of medication management and communicating with patients and carers. The standards also apply to small rural hospitals, although rural facilities have raised concerns about their ability to meet the standards (Australian Commission for Safety and Quality in Health Care, 2012b).

Residential aged care facilities in Australia are also required to demonstrate appropriate medication management as part of accreditation. Standard 2.7 of the *Accreditation Standards* requires medications to be managed safety and correctly. In Tasmania, medication management within the disability sector occurs in relation to the *Quality and Safety Standards Framework for Tasmania's DHHS Funded Community Sector (2013)* which are linked to the Quality Frameworks associated with the National Disability Insurance Scheme (National Disability Insurance Scheme, 2013).

Other approaches underway in Australia relating to medication management include a set of recommended terminology for prescribing medications, a national medication chart (now available in a variety of formats with one for residential aged care now in trial), tall lettering and documentation of allergies (Australian Commission for Safety and Quality in Health Care, 2011a, 2011b, 2014). Many of these interventions are in their infancy so there is limited research available regarding their success. One study of the national inpatient medication chart (NIMC) suggested that its use is effective in reducing prescribing error (Coombes et al., 2011) and audits indicate varying levels of compliance with requirements (Australian Commission for Safety and Quality in Health Care, 2013c).

The translation of policy and interventions such as the NIMC and open disclosure into clinical practice are an ongoing challenge. Studies have identified that in relation to error practitioners often experience tensions such as having to balance productivity and safety. For example, research has shown that if staffing levels are adequate the practices amongst nurses in an emergency department improve (Mitchell Scott, Considine, & Botti, 2014).

2.9 Summary of background and context

The issue of patient safety is a complex one. Studies in several countries have identified that preventable error occurs in health care (Baker & Norton, 2004; Baker et al., 2004; Brennan et al., 1991; Wilson et al., 1995). Health care is delivered in a changing environment. Although there are similarities with other industries some issues are specific to health care (Reason, 2013). It has been proposed that *resilience engineering* may be an appropriate means of managing error (Qureshi, 2007). This may be appropriate as health care is complex and *resilience engineering* acknowledges that organisations function as complex adaptive systems.

Further adding to the complexity, different definitions exist for terms such as *error* and *disclosure.* Therefore, this research will use terminology developed for the local context by the *Australian Commission for Safety and Quality in Health Care.*

Error management is important to ensure reduction in harm as well as costs. Numerous mechanisms are in place for this purpose including accreditation and more specific interventions for areas such as medication management. Nurses have a role to play in the prevention of error as well as participating in disclosure. Patient involvement is also important and medication management is an area noted here where this involvement could be improved.

Despite this knowledge, over time enquiries have found shortfalls in the delivery of health care services (Francis, 2013; Queensland Health, 2005; Skinner et al., 2009). Included in findings have been concerns about cost-cutting and culture.

Issues surrounding error and disclosure have been introduced in this chapter. There has also been some reference to the importance of culture in relation to each of these. The issue of culture, error and disclosure will be examined in more detail in the next part of this chapter.

Part II: The literature informing the research

Having undertaken an overview of the context of patient safety related to error and its disclosure with particular reference to the Australian context it is now possible to consider the literature that informs this research. The first step in this process is the presentation of publications found from a structured search relating to error reporting, error disclosure and nursing which highlights the range of publications for each area.

Following this, literature that establishes the non-reporting and non-disclosure of error is presented. Several areas pertaining to differences in each of these areas are then considered, such as severity of harm, workplace setting, work role and other factors.

The issue of culture and safety climate is then discussed with further consideration given to differences again with respect to workplace setting, work role and other factors. This is followed by the review of literature relating to the relationship between safety climate and error reporting and disclosure.

Areas of deficit in relation to this subject are then put forward. These inform the development of the aim of this research as well as the research question.

The literature in relation to error reporting is extensive and for this reason it was not possible to undertake a systematic review for this research. A simple search in two key databases (*Pubmed* and *CINAHL*) conducted on 31 March 2015 shows the degree of research that is available in this subject area. The results of this search indicating the number of publications returned appear in Table 2-1. Although more exhaustive search terms may produce more publications for both error reporting and disclosure this table suggests there is substantially less research available on the topic of error disclosure.

Table 2-1 *Publications from search of databases conducted on 31 March 2015*

Search term	Timeframe	PUBMED	CINAHL
(error) AND report*	Overall	20 518	2 869
	Last 5 years	6 696	1054
	Last 10 years	11 462	2034
(((error) AND report*)) AND nurs*	Overall	976	609
	Last 5 years	383	231
	Last 10 years	645	446
(error) AND disclos*	Overall	870	239
	Last 5 years	318	91
	Last 10 years	576	198
error AND disclos* AND nurs*	Overall	79	55
	Last 5 years	24	20
	Last 10 years	57	44

Another observation from this table is the comparatively low number of publications when the term “nurs*” is added to the search terms. Whilst the search in Pubmed identified more than 20 000 from the search “(error) AND report*” there were only 976 publications identified when “nurs*” is added. This figure represents less than 5% of the previous search. There is also clearly substantially fewer publications in relation to error disclosure compared to error reporting.

On 30 June 2014 there were 362 450 registered, enrolled nurses and midwives in Australia compared to 99 379 registered medical practitioners (Australian Health Practitioner Regulation Agency, 2014). For a profession so high in number, with a role in the delivery of direct patient care, it is hard to explain why research in the areas of error reporting and disclosure in nursing is a comparatively low percentage of the overall research.

The above search was conducted in order to present the differences in published research for error reporting and disclosure both broadly and more specific to nursing. The literature presented in the following sections has been identified through more extensive database searches conducted over time, hand searches of journals (particularly *BMJ Safety and Quality,* and *Medical Journal of Australia*), grey literature (from *Institute of Medicine* and *Australian Policy Online)* and websites such as the *Australian Commission for Safety and Quality in Health Care.* It is not an exhaustive narrative but one designed to present the thematic areas relevant to the subject of this research, namely error reporting, error disclosure and safety climate.

2.10 Non-reporting and non-disclosure of error

The non-reporting and non-disclosure of error is evident amongst the literature with some alarming figures to be found in research relating to this area. Some studies focus on the views health professionals have regarding reporting their own errors and/or the errors of others. Other studies have used observational approaches to detect the amount of error that is reported with some studies comparing both.

A survey of Israeli nurses showed that whilst only 6% of nurses stated they would "never" report their own errors, 50% admitted to "rarely" or "sometimes" reporting an error (Kagan & Barnoy, 2008). Similarly a survey of Taiwanese nurses estimated that 47% of respondents had failed to report themselves or a co-worker in relation to medication adverse events (Chiang, Lin, Hsu, & Ma, 2010). Yet another survey conducted amongst Korean nurses found 50.6% of nurses were unclear which errors needed to be reported (Kim, An, Minah, & Sook, 2007). Despite 82.8% of respondents to this same study believing error reporting was important only 58.5% felt reporting errors led to improved patient safety.

A study of barriers and reporting in mental health settings found less than half the nurses would report either an error made by a colleague or a near miss error that they made themselves (Haw et al., 2014). Themes identified for non-reporting included fear (of litigation, disciplinary action or loss of faith from colleagues), lack of knowledge (of process or definition of error), burden of work and excusing the error (particularly near miss error). This study concluded that mental health nurses did not report errors for similar reasons to their general medical nursing counterparts.

Nurses report fewer errors than the errors they actually make, citing perceived fears of reprimand and punishment, and blaming individuals as opposed to system failures as barriers to reporting (Bayazidi, Zarezadeh, Zamanzadeh, & Parvan, 2012). A direct observational study of nurses administering medications in two Australian hospitals reflects this result with an audit indicating that only 1.2 per 1000 incidents had reports filed and of the prescribing errors noted (218.9 per 1000) only 13 per 1000 were reported (Westbrook et al., 2015).

The disclosure of error by nurses has been defined in the past as informing the physician when an error has occurred with full disclosure to the patient being the responsibility of the physician (Kelley, 2002). This may explain why, as indicated earlier, the majority of research relating to disclosure involves the perspective of physicians (O'Connor et al., 2010). Whilst such studies confirm that that medical professionals support the notion of disclosing error the practice of disclosure is not consistent with that support.

It has also been noted that there are few studies in relation to the involvement of nurses in disclosure (Wagner, Harkness, Hébert, & Gallagher, 2012) although it has been suggested that nurses balance their personal welfare, professional reputation and patient interests when determining whether or not an error should be disclosed (Kelley, 2002)

Studies have found differences between rates of error reporting and disclosure. For example a study of emergency department personnel found that physicians, nurses and emergency medical technicians were more likely to report an error than to inform the patient (Hobgood, Bowen, Brice, Overby, & Tamayo-Sarver, 2006; Hobgood, Weiner, & Tamayo-Sarver, 2006). Another study comparing reported medication errors between intensive care units (ICU) and non-ICU settings found that when an error occurred the patient and caregivers were not informed (Latif, Rawat, Pustavoitau, Pronovost, & Pham, 2013).

A qualitative study amongst nurses in China found that of the seven nurses recruited who admitted they had made mistakes in administering medication none of them disclosed the error to patients or family (Luk, Ng, Ko, & Ung, 2008). This was despite the participants feeling they were treated fairly during the process of investigating the errors.

In contrast, a US study found that hospital leaders indicated that it was more likely a patient would be informed of an error (particularly one of moderate or near miss harm) than an error being formally reported to the state (Weissman et al., 2005). The values reported for this study combined the "*always*" and "*usually*" responses. It is not possible to determine if this aggregation has led to the results contrasting to other studies or whether senior managers hold different views.

2.11 Severity of harm and error reporting and disclosure

The level of harm that occurs from error varies as do the levels reporting and disclosure relative to harm. Generally, errors of higher severity are more likely to be reported or disclosed despite errors of lesser harm being more common.

For example, a study which identified numerous errors in prescribing on admission to a large acute medical unit in UK found the rate of severe error quite low (1%) compared to that of moderate (11.8%) and near miss error (87.2%) (Basey, Krska, Kennedy, & Mackridge, 2013). Reporting data from the NSW Clinical Excellence Commission in 2010 reflects a similar pattern. The rate of errors reported varied with the more severe level of clinical incidents reported reflecting 0.04% of hospital admissions to the least serious category rate of 9.94% of hospital admissions (Atkins, De Lacey, & Britton, 2014).

One study found that reporting rates for a serious error were higher (62.5%) than near miss error (50.7%) with just 3.5% of serious errors and none (0%) of the near miss errors disclosed to patients and families (Sheu, Wei, Chen, Yu, & Tang, 2009). Another study using a cross-sectional survey of a convenience sample found that the identification, disclosure and reporting of error decreased as error severity decreased (Hobgood, Weiner et al., 2006).

The previously cited Israeli study found that although 16.9% of nurses indicated they felt all errors were reported although where patient harm was involved responses that the error was *"always"* reported were higher (66.8%) compared to near miss errors (17.4-17.2%) where the error either resulted in no harm or actions were halted before an error was made.(Kagan & Barnoy, 2008).

Similar results have been found in relation to error disclosure. Disclosure rates from ICU (1.5%) were lower than the non-ICU settings (2.1%) with the ICU errors causing harm (6.6%) more frequent than the non-ICU environment (3.7%) (Latif et al., 2013).

Severity of harm has also been linked to punitive action amongst pharmacy boards in the US (Holdsworth, Wittstrom, & Yeitrakis, 2013). This study found error severity was one of the main elements leading to punitive action such as licence suspension, probation and fines.

Although not directly related to professionals a study of health plan members who were mailed videos of two vignettes depicting medical error and disclosure found that, even with full disclosure, most respondents indicated they were likely to seek legal advice (Mazor et al., 2004). However, this same study found that whilst most (83%) thought financial compensation was appropriate for error resulting in harm there was a much lower response (12.7%) indicating they felt compensation was appropriate if no harm occurred.

In light of the previous discussion regarding less severe errors being under-reported combined with the data indicating lower levels of harm are less likely to be reported, it is clearly likely that there is a large amount of error that is not captured within error reporting systems. This may reflect fears of the risk of litigation (Haw et al., 2014; Studdert & Richardson, 2010). The HMPS found 27.6% (95% CI 22.5-32.6%) of error was the result of negligence although this rate increased with the severity of error.

However, there may be other reasons why near miss errors are not reported. A study in the chemical industry found that workers did not consider that when they intervened in relation to a near miss error they did not consider it to be an error at all (Kanse, 2004). A recently published Australian study found nurses tended to have a similar view (Hewitt & Chreim, 2015)

What should be reinforced here is the relatively low level of severe harm compared to lesser levels. The more severe an error is, the more likely it is to be reported suggesting that what is known about error reflects the more severe end of the spectrum. This reflects a *Safety I* approach to error management in health care which is to detect and report a lack of safety (Hollnagel, 2014).

2.12 Error reporting and disclosure in different workplace settings

It was identified over a decade ago that little was known about error in the rural context (Wholey, Moscovice, Hietpas, & Holtzman, 2004). A short time afterwards the Institute of Medicine in the US recognised the uniqueness of rural settings (Institute of Medicine, 2005). It laid out the key areas that need to be addressed including the needs of the population, an appropriate support structure, improving human resources, adequate funding support and use of appropriate technology (Institute of Medicine, 2005). The report also acknowledged the poorer health and economic circumstances that many US rural areas face.

There is limited research available in relation to error reporting in the rural context. A study of small rural hospitals in Nebraska found 99% of errors reported were near miss errors (Thornlow, 2008) reflecting other studies cited in relation to the influence of error severity. Results from this study also suggest that the involvement of pharmacists in small rural hospital medication management assists in improving the reporting rates and identification of prescribing error, with the latter leading to a reduction of errors reaching the patient.

A more recent cross-sectional study carried out amongst 48 rural and urban primary care centres in Spain found that most health professionals indicated 64.3% of adverse events were preventable (Aranaz-Andrés et al., 2011). Of these 5.9% were considered to be severe. In addition nurses reported more adverse events as preventable compared to other professions. The majority of adverse events were adverse drug reactions or medication errors, with the serious events considered more preventable. Unfortunately this study did not report any comparison between the rural and urban results.

Context has been highlighted as important for future research in order to improve disclosure practices with the majority of research undertaken to date occurring in secondary care hospital environment (Birks et al., 2014). However there are some studies that have been undertaken outside such settings.

Thirteen of the individuals interviewed for the *One Hundred Patient Stories Project* were either themselves, or their family, from a rural area. These patients identified issues with the diagnosis, transfer and treatment process as well as the process of open disclosure (Piper, Iedema, & Bower, 2014). Participants reported that training and geographical isolation meant diagnosis was often delayed and a lack of resources, including faulty equipment and staffing issues, was identified as a precursor to incidents.

Even if the equipment was functioning, often staff did not know how to use it, or there was no qualified doctor at the facility to which the patient was transported. These observations are reinforced by the findings of a report that rural hospitals feel ill-equipped and under-resourced in relation to their capacity to meet the new Australian hospital accreditation standards (Australian Commission for Safety and Quality in Health Care, 2012b).

Another study set in nursing homes found that there was an increased likelihood that nurses would disclose more information relating to errors if there was less harm or if the resident concerned was cognitively impaired (Wagner, Harkness, Hébert, & Gallagher, 2013). The authors postulated that this was due to family members being involved and it being easier to disclose information if there is little harm.

The contribution of nurses to the disclosure process was the subject of a systematic literature review which found just 15 studies on this subject (Harrison et al., 2014). This review found that despite the potential for nurses to be involved in the process of open disclosure the hierarchical nature of health care is often a barrier although the demands of work and a fear of punitive action or disproportionate blame for the incident were also restrictions to the involvement of nurses. This review concludes that through overcoming such barriers there is potential for nurses to be more involved in open disclosure with potential for them to support both patients and physicians through the process.

2.13 Error reporting and disclosure amongst different work roles

There are two areas where differences have been noted in relation to error reporting based upon role. These are differences amongst professions and differences between managers and other nurses.

One study found that physicians were less likely to report an error than nurses or emergency medical technicians yet physicians were more likely to disclose an error to a patient (Hobgood, Weiner et al., 2006).

Another found that whilst only 17% of respondents reported disclosing error 39% admitted to apologising for situations resulting from errors. That is, some medical staff would apologise for a situation without the underlying explanation that it had resulted from a mistake (Kronman, Paasche-Orlow, & Orlander, 2012). .

Differences in views about reporting have been noted across different professions from a survey undertaken at Aberdeen Royal Infirmary in Scotland (Sarvadikar, Prescott, & Williams, 2010). Whilst results indicated that all professions were more likely to report serious errors that caused actual harm to patients nurses and pharmacists were likely to report all errors compared to doctors who were more likely to report an error with a severe outcome.

In a previous study using scenarios across different levels of harm it was found that senior hospital staff in the USA had different views about different levels of harm for both reporting and disclosure (Weissman et al., 2005). However, it has been noted by others that there are gaps between what managers view they would report in relation to their actions compared to what is actually happening in practice (Morello et al., 2013). Therefore actual reporting and disclosure rates may be lower than this study indicated.

In Korea, similar results were found amongst nurses where more senior nurses indicated they reported error more frequently compared to the clinical (staff) nurses (Kim et al., 2007) which was also the case in a more recent Israeli study (Kagan & Barnoy, 2013). Whilst this may explain the differences noted between managers and clinicians it is also possible that if clinicians are not involved in disclosure they may not be aware when an error is formally acknowledged.

Another study found that 75% of nurses and physicians were not reporting error. (Scherer & Fitzpatrick, 2008). A further study that investigated hospital nurses and their reporting of medication adverse events found differences in attitude between self-reporting and reporting others' errors. Although 18.3% of respondents admitted to not self-reporting their errors, 36.8% of respondents admitted not reporting the errors of their co-workers (Chiang et al., 2010).

2.14 The impact of other factors upon error reporting and disclosure

Several other areas have been identified where differences in reporting or disclosure have been found. These include experience and age, ethical reasoning, burnout and education.

Experience of error has been found to be linked to error reporting with one study finding younger respondents had no experience of either reporting their own errors or the errors of their co-workers and those with less experience of making errors were more likely to underreport (Chiang et al., 2010). This mirrors results from Korea where there was increased likelihood of more experienced staff reporting errors (Kim et al., 2007). Nurses with experience of underreporting have also been found more likely to perceive barriers to reporting such as fear, nursing quality and nursing professional development (Chiang et al., 2010).

Ethical reasoning has been linked to error disclosure. A study in the USA found that positive ethical reasoning scores were associated with acknowledging error (Cole, Block, & Wu, 2013). Although his study had a low sample and low response, the results indicated significance.

Whilst burnout has not been associated with event reporting it has been associated with low reporting rates of near miss error (Halbesleben, Wakefield, Wakefield, & Cooper, 2008). High levels of stress and demands on the community sector have been also noted (Dollard & McTernan, 2011).

Longer work hours have also been associated with increased risk of errors and near miss errors with a decrease in vigilance from nurses also observed (Scott, Rogers, Hwang, & Zhang, 2006). This particular study was located within an intensive care setting which is arguably an area of high demand. Work patterns have also been noted as a potential barrier to error disclosure (Harrison et al., 2014).

It has been noted that academic nurses have higher rates of error but lower reporting rates (Kagan & Barnoy, 2008). Education has also been linked to improving medication error reporting along with improving communication and ensuring reporting is not burdensome (Hartnell, MacKinnon, Sketris, & Fleming, 2012). Feedback has also been highlighted as a facilitating factor (Hartnell et al., 2012).

Another study found that there was no difference in the rate of medication error in nursing homes based upon staff qualifications or role (ie nurse, aide, medication technicians) (Scott-Cawiezell et al., 2007). However this study did find that Registered Nurses had more interruptions when administering medications and these were associated with increased medication error rates when excluding wrong time errors.

Education is also an important issue when considering error disclosure. A lack of training has been identified as a barrier to error disclosure along with fear, blame and punitive culture (Harrison et al., 2014). An Australian study found that the majority of respondents in four states were unaware that there were apology laws in their state that were related to open disclosure (Studdert, Piper, & Iedema, 2010). It is worth noting that the recruitment strategy of this study was focused on those considered to be leaders in open disclosure.

The lack of education and training has also been noted in the UK (Birks et al., 2014). This study also found there was poor knowledge of any training that may be available.

The notion that education is important to improving error disclosure is supported by the findings of a study conducted in aged care. Registered Nurses with more education and having had prior experience with error disclosure were found more likely to provide more information about an error to nursing home residents (Wagner et al., 2013). Education was also highlighted in the review of the Australian *Open Disclosure Pilot* along with careful planning, support for staff involved and monitoring of the impact upon patients (Iedema et al., 2008).

2.15 Culture and safety climate

Organisational factors have been identified as associated with latent error and are regarded as key to the prevention and management of error. Failures in health care are considered to be the product of organisational culture, health care profession culture and the health system culture (Walshe & Shortell, 2004). Culture is also considered an important factor for improving error disclosure.

Defining *culture* is not an easy process and the term has been described as one of the most complicated words in the English language to define (Williams, 1983). It has been argued that the word has become overused and it is better to be specific by breaking the term down to the component parts of interest (Bennett et al., 2005). The term is certainly complex in respect to safety with numerous examples of the elements that can be considered to be a part of *safety culture.*

A review by Glendon (2008) makes this very point. He defines several elements including safety climate, safety compliance and safety participation. Safety climate is described as shared attitudes, values and beliefs around safety. Safety compliance is the undertaking of tasks or duties in order to comply with safety requirements whereas safety participation refers to an enthusiasm to participate in those same tasks.

It has been noted that there is no consensus on the definition of safety culture (Walshe & Shortell, 2004). A recently published review of definitions of safety culture and safety climate found that there is much disagreement within health care about how these terms should be defined. (Halligan & Zecevic, 2011). This review found disagreement about whether the two terms are linked or whether they are entirely separate.

Rather than attempt to define safety culture the approach taken for this research is to consider the element of safety climate and situate this within the broader context of organisational culture. A systematic review (Morello et al., 2013) of strategies to improve patient safety culture in hospitals has presented a model for patient safety culture that will be used for the purpose of defining safety culture and safety climate for this research.

This model defines organisational culture as the core shared beliefs, values and norms identified amongst the organisation's employees (Morello et al., 2013). Influenced by organisational culture, as well as being influenced by it, is patient safety culture which encompasses the individual and group beliefs, values and norms identified in relation to the management of the organisation's health and safety. Patient safety climate is the shared perceptions of the beliefs, values, norms and practice that achieve patient safety. Patient safety climate also influences and is influenced by patient safety culture. It in turn influences and is influenced by the beliefs and attitudes of the individual with respect to patient safety. This model therefore acknowledges the complexity of safety culture and outlines the components that are situated within it.

The systematic review concluded that there was limited evidence that strategies have had any impact upon safety culture outcomes (Morello et al., 2013). Some evidence existed that leadership walk-rounds may have an impact for nurses and that multi-faceted unit-based patient safety programs (with a structured framework for assessing, identifying reporting and improving patient safety issues/concerns) may also have a positive impact. However, the review authors note that there were other studies that had found conflicting results.

The authors also noted that culture is embedded in groups and sub-groups and that organisations are dynamic (Morello et al., 2013). This becomes more evident through the consideration of some of the literature in relation to error reporting, error disclosure, safety climate and the relationship between each of these.

Most research undertaken in relation to safety climate in health settings has used quantitative surveys (Halligan & Zecevic, 2011). A recent systematic review of surveys designed to assess teamwork in health care settings found the different variations in how safety climate is measured could be confusing (Valentine, Nembhard, & Edmondson, 2015). The authors of this review recommended the adaption of one of the existing valid tools rather than developing a new one.

The most used instruments are the Safety Attitudes Questionnaire (SAQ) and Hospital Survey on Patient Safety Culture (HSOPSC). In reviews of the use of such instruments in health care both have been determined as reliable and valid (Colla et al., 2005; Flin, Burns, Mearns, Yule, & Robertson, 2006). Of the two, the SAQ is considered more reliable to assess safety climate across a whole health system whereas the HSPOSC provides a better assessment of safety climate within a single hospital or service (Etchegaray & Thomas, 2012).

One study comparing Swiss and US hospitals reported differences in factor scores between the two countries with units in both hospitals indicating low thresholds (a score of less than 60%) for stress recognition and perceptions of unit management (Schwendimann, Zimmermann, Küng, Ausserhofer, & Sexton, 2012). There was no difference found for teamwork climate, job satisfaction and working conditions when mean scores were compared.

2.16 Safety climate in different workplace settings and work roles

Variations in safety climate have been found in different workplace settings. For example one study suggests staff in long term care settings have a more positive safety culture compared to those in acute hospitals (Vlayen et al., 2011). Another, using the HSPOSC, found most subscale scores were lower in nursing homes compared to hospital settings (Castle & Sonon, 2006).

A study of rural settings found changes in safety culture occurred over time following the implementation of a voluntary medication error reporting system (Jones et al., 2008). This study also found that safety culture varied by extent of participation in a patient safety program. It is difficult to ascertain whether this would relate to an educational activity, supporting previous comments in relation to education or whether this may be an example of the difference between safety compliance and safety participation (Glendon, 2008). It has also been identified that safety climate varies at the level of a clinical department rather than at the level of a hospital (Freeth, Sandall, Allan, Warburton, & Berridge, 2012).

Safety climate has also been found to vary according to workplace role. This reflects what has already been outlined earlier in this chapter in relation to error reporting and disclosure (Section 2.13).

One study found differences amongst administrators within aged care settings (Castle, Engberg, & Anderson, 2007). Safety culture was more likely to be positive amongst those who were working in not-for-profit facilities. Another study found staff working as nurses' aids in aged care had lower scores for safety climate compared to hospital benchmark scores (Castle, Engberg, & Aiju, 2008).

Within the Australian setting a report produced for the South Australian Health Department found similar results. Those working in management roles were more likely to have higher mean scores for SAQ questions compared to those working in clinical roles (Braithwaite et al., 2009). That is, based upon the average score for items of the SAQ responses were higher amongst managers which indicates a difference between staff working in management compared to those working in non-management roles.

2.17 The impact of other factors upon safety climate

One study that has looked at differences in this area found that safety climate level (the perception of importance given to safety issues) has a larger effect than the strength of safety climate (the degree of consensus with the level) (Keren, Mills, Freeman, & Shelley II, 2009). This same study found that whilst safety climate may be likely to predict the selection of a safer choice it fails to predict orientation toward safety during the processing of information thus highlighting the possibility of peer pressure to influence decision making around reporting. Where safety was seen to be prioritised over productivity reporting was more likely to occur.

Both organisational dynamics as well as individual characteristics have been identified as having significant correlational relationships with respect to error (Moody, 2006). This study found cognitive style and manager actions and expectations were predictive for the incidence of nurses reporting medication errors while open communication and the patient safety grade (which relates to patient acuity) correlated with frequency of error reporting.

Along with the focus on the measurement of safety climate there are also those who argue for qualitative research studies to be conducted (Halligan & Zecevic, 2011). Methodology is one area where it has been acknowledged that the limitations of a quantitative approach leave some aspects of safety culture underexposed (Vlayen et al., 2011). An example of this may be the previously referred to elements of safety participation and safety compliance (Glendon, 2008).

2.18 Safety climate, error reporting and error disclosure

Having reviewed the literature in relation to error reporting and disclosure it has been identified that there are differences have been to be found that are based upon different workplace settings and work roles as well as other factors. Research relating to safety climate has produced similar results.

There is limited research available with respect to the relationship between safety climate and error reporting. Although not specifically considering the issue of safety climate, the previously cited Korean study found elements related to safety climate. For example 45% of respondents felt staff members were afraid to report mistakes and 10% felt errors were held against them. There were 10.7% of respondents who agreed that finding the person responsible for an error was important. Some (30.8%) indicated they agreed with the statement they were worried their mistakes were kept on file (Kim et al., 2007). Although 70.8% felt informed about errors that occurred, only 52.1% felt that when errors occurred people were given feedback (Kim et al., 2007). These results suggest nurses fear reporting from the perspective of the impact it has upon them as an individual.

Safety culture has been linked to the frequency of event reporting (Kagan & Barnoy, 2008) (Etchegaray & Thomas, 2012; Hutchinson et al., 2009). Higher scores have also been associated with lower incident rates (Kagan & Barnoy, 2008) and fewer medication errors as well as other clinical outcomes such as lower ventilator-associated pneumonia, fewer infections of the bloodstream and reduced length of stay in intensive care units (Colla et al., 2005). However, a more recently published pilot meta-analysis concluded there was no relationship between safety culture and medication error although the authors acknowledge an assessment of methodology was not undertaken as part of this review (Groves, 2014).

Safety culture dimensions are not the only element with a degree of predictive validity. A new measure that is argued predicts intent to disclose error better than other measures of healthcare culture has been developed (Etchegaray, Gallagher, Bell, Dunlap, & Thomas, 2012). This same tool used the safety and teamwork dimensions of the SAQ but found that these did not predict error disclosure. This study used another method of analysis focusing on mean scores rather than on whether the factor score was high.

The factors that were related to improved error disclosure were general culture and error disclosure trust culture (Etchegaray et al., 2012). Participants with education in disclosure had higher scores for both these factors, a point that supports previous discussion regarding the importance of education (Section 2.14).

Other studies suggest a link between safety climate and error disclosure. A survey of medical staff in the USA found that the summary score from the study was positively associated with both error disclosure and apology (Kronman et al., 2012)

A study of culture and open disclosure in Ireland found that staff felt the approach to disclosure was unstructured and 24% of respondents feared litigation (Duffy, 2012). The respondents to this study also highlighted barriers from culture and lack of support for staff as concerns.

2.19 Summary

It is clear from the research presented here that nurses and other professionals do not report and disclose all error. Areas of difference have been noted based upon workplace setting, work role and other areas such as education. This is clearly a complex area and not one where a simple linear relationship may be identified.

Similar complexity exists in relation to safety climate where differences have been found in relation to many of the same areas. When considering the relationship between safety climate and the reporting and disclosure of error, again, a similar complexity arises.

A large amount of research has been undertaken in relation to error reporting, however there is less available relating to error disclosure. This is evident from the search strategy presented at the commencement of Part II of this chapter. There are some areas where research is lacking, including research in the rural context and research that includes nurses particularly in relation to error disclosure. It has also been highlighted that medication error is both prevalent and a significant cost to the Australian health system.

Although there is information about the occurrence of medication error in the Australian context, little is known about the views of reporting and the disclosure of such errors that occur in rural services, within Australia or globally. Health workforce data indicates that nurses in rural areas work in a variety of different workplace settings including hospitals, aged care, community and general practice (Australian Institute of Health and Welfare, 2013). Nurses are also actively involved in medication administration (Choo et al., 2010).

Drug -related error was the highest non-operative error detected by the HMPS, the majority of which were the result of wrong dose or therapy or inadequate post therapy follow up (Leape et al., 1991). Reporting data from NSW shows that the medication error is the second highest error type reported (the highest is for falls) (Atkins et al., 2014).

A lack of information in relation to error reporting and disclosure indicates this is an area for future research. Whilst the lack of information is global, the Tasmanian context offers the opportunity to research this issue within a single health system across different settings.

A hypothetical medication error will be used for this research. This reflects the approach taken by several of the studies referred to in this chapter where error scenarios have been used in order to investigate medication error and/or views of reporting and disclosure.

The literature review has indicated that although there may not be a relationship between safety climate and medication error, there is a lack of information available on this issue within the rural context. There is no known research relating to safety climate and views of reporting or disclosure amongst nurses working in rural clinical settings indicating this is an area in need of further research.

2.19.1 Aim of the research

The literature review has established there is limited information available about safety culture amongst nurses working in rural clinical settings. The bulk of the research undertaken uses surveys to measure safety climate, teamwork and other factors. Workplace setting, work role and other factors have been identified as having a potential impact on the level of safety climate. Error reporting, error disclosure and medication error are possibly influenced by these same factors.

Clearly, the nature of safety culture is quite complex. An example of that complexity is the possible relationship between safety climate and error reporting and disclosure. Although some studies suggest there may be a relationship, a recent review found there was none. There are no known studies on this issue that have been undertaken in the rural context.

Thus the aim of this research is to *describe the complexity of safety climate of nurses working in rural clinical settings.* The research question is: *how is safety climate related to views of reporting and disclosure of medication error amongst nurses working in rural clinical settings?*

Determining how safety climate influences views of reporting necessitated the collection of information relating to each of safety climate and views of reporting and disclosure. Therefore, to inform the research question the first three research sub-questions were developed. These are:

1. *What level of reporting and disclosure of different severity of a hypothetical medication error do nurses in rural clinical settings think is occurring?*

2. *What is the nature of workplace safety climate amongst nurses in such settings?*

3. *What is the relationship between workplace safety climate amongst nurses in rural clinical settings and their views of reporting/disclosure of a hypothetical medication error?*

These three sub-questions identify that the research will be conducted in rural clinical settings amongst nurses. They also clarify that the research relates to safety climate, error reporting and error disclosure.

2.20 Chapter summary

The complexity of health care delivery has been established in this chapter. In particular, the complexity of the relationship between safety climate, error reporting and error disclosure has been noted.

It has also been identified that nurses, although involved in error management and disclosure are not always included in research. The body of research in relation to rural clinical settings is also lacking. Having identified the subject matter of this research and developed a research aim and question the issue of how best to research the subject now needs to be considered.

The bulk of research presented in relation to error reporting has focused on the measurement of the error that is actually reported or is viewed as being reported. The systematic review of how nurses are involved with the process of error disclosure also found more quantitative studies than qualitative (Harrison et al., 2014). Although it has been argued that research of safety climate needs to encompass both qualitative and quantitative methods the main approach to obtaining data in relation to safety climate is through quantitative surveys (Halligan & Zecevic, 2011). There are calls for new methods to be applied in patient safety research including more qualitative research (Iedema, 2009; Jorm & White, 2009;

Vincent, 2009). How best to conduct this research in a manner that acknowledges complexity will be considered in the following chapter.

3 Researching complexity in health care

3.1 Introduction

Health care consumers receive care from numerous practitioners who in turn are usually caring for numerous others. Care is also delivered in a variety of settings. Although the majority of consumers receive health care safely, there are times when an error occurs that leaves a consumer harmed. At other times the same error may not cause any harm at all. Such is the complexity of health care delivery.

As outlined in the previous chapter, the nature of error management, reporting, disclosure and safety climate is complex. More recent approaches to error management acknowledge some industries, including health care, are complex technical systems. Numerous factors such as workplace setting and work role may influence reporting and disclosure as well as safety climate. Although there may be a relationship between safety climate and views of reporting and disclosure of error, the nature of any relationship may be complex and requires further investigation.

In order to address the aims of this research and *describe the complexity of safety climate of nurses working in rural clinical settings* a research question has been developed. This question asks: *how is safety climate related to views of reporting and disclosure of medication error amongst nurses working in rural clinical settings?* The research question assumes there is a relationship between safety climate and nurses' views of reporting and disclosure of medication error. Although the research question does not make any assumptions about the nature of that relationship, the research aim assumes that the subject of safety climate amongst nurses in rural clinical settings is complex.

For the relationship between safety climate and views of reporting to be determined it is necessary to consider the separate elements. Subsequently three research sub-questions have been developed. These are:

1. *What level of reporting and disclosure of different severity of a hypothetical medication error do nurses in rural clinical settings think is occurring?*

2. *What is the nature of workplace safety climate amongst nurses in such settings?*

3. *What is the relationship between workplace safety climate amongst nurses in rural clinical settings and their views of reporting/disclosure of a hypothetical medication error?*

Having determined the aim, research questions and sub-questions, the remaining issue is adopting the best approach to undertake the research. In doing so, the issue of complexity needs to be acknowledged.

Health care is complex. Therefore the use of research methods designed to understand complexity is an obvious choice. However, as will be put forward here, there is a debate about the most appropriate methods to use for this.

Arguments for new approaches to researching quality and safety are evident in health care (Jorm & White, 2009; Vincent, 2009) (Iedema, 2009), reflecting similar arguments in other industries (Glendon, 2008). Despite this, there is little to suggest that policy or funding for research has increased the use of other methods (Khushf, Raymond, & Beaman, 2008).

Debates surrounding different methods indicate a tension between how research is currently undertaken and how it should be done. Whilst discussion tends to be focused on the benefits of either quantitative or qualitative research, there is also an underlying tension between different worldviews.

The dominant view within health care is that of *evidence based medicine.* This contrasts with an alternative view proposed by *complexity science*. These two different views are discussed within this chapter. This is followed by consideration of health care as a complex system and a framework for how knowledge is formed within that system. The issue of how to research such complexity is then addressed, leading to the introduction of configurational comparative methods and their use in research for the purpose of understanding complexity.

These matters are then given consideration in light of what has already been noted in the previous chapter in relation to the complexity surrounding safety climate and the reporting and disclosure of medication error. The chapter then concludes with two further research sub-questions that inform the main research question and research aim.

3.2 The influence of evidence based medicine

In 1992 *evidence-based medicine* (EBM) emerged as a new approach for improving medical care (Evidence-Based Medicine Working Group, 1992). Although having its origins in the mid-19th century (Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996) the more recent use of the term applies to the systematic search of literature and its evaluation using *rules of evidence* (Evidence-Based Medicine Working Group, 1992). Alongside this process is the judgement of the clinician and the patient preference (Haynes, Devereaux, & Guyatt, 2002).

The steps required for *evidence based medicine* were the development of an answerable question, systematically searching for the best available research to answer that question, critically appraising the research found (including applying *rules of evidence*) and integrating this appraisal with clinical experience and the patient preference and then evaluation of the outcome of the care delivered (Straus & McAlister, 2000). The *rules of evidence* regard that randomised control trials (RCT) and meta-analysis provide a higher level of evidence compared to other research methods and these have become the “gold standard”, although it has been noted that there are other forms of evidence that can inform practice (Sackett et al., 1996).

The approach is not without its critics. A subsequent systematic review has identified several limitations to the application of EBM including the absence of coherent evidence in some areas, difficulties applying the evidence in some patient situations and barriers to practising high quality medicine (Straus & McAlister, 2000). Further issues identified by the same review were that the clinician needed to have the skills to undertake the process, limited time and available resources and that there is a limited amount of research indicating that evidence based medicine is effective.

Overall, the focus of the evidence is upon empirical research of intervention and outcome. This process, whereby research is effectively reduced to cause and effect element, is referred to as *reductionist* (Martin & Sturmberg, 2009). Also referred to as *Newtonian* or *Newtonian Science,* it is considered flawed particularly when applied to organisations as such an approach assumes stability (Anderson, Crabtree, Steele, & McDaniel, 2005). In other words, when measuring an intervention against an outcome there is an assumption that all other factors will remain constant. For example, in designing a study considering the relationship between safety climate and error reporting and disclosure, the adoption of a Newtonian approach would assume that “safety climate” was an intervention, “error reporting and disclosure” the outcome and all other factors would be assumed to remain static.

Use of the term has extended to other areas beyond health care with commentaries in social science acknowledging a need to focus on empirical research in order to inform evidence based approaches in the political and social context (Mykhalovskiy & Weir, 2004). Others within medicine have argued that the original model was limited and there is a need for a broader focus on clinical expertise (Haynes et al., 2002).

The insistence from those working in public health that explanations and identification of complexity is obtained through studies that are artificially controlled (Martin & Sturmberg, 2009) results in complexity not being dealt with well in health care research. Such complexity lies within the individual, the system and the organisational infrastructure not merely with an intervention (Miles, 2009). The use of terms such as *evidence* and *evidence-based* are common amongst even the layperson and the use of such reductionist approaches to research resulted in a similar reductionism in how issues in health care are dealt with (De Simone, 2006).

Policy has also been influenced by this approach with the dominance of EBM leaving social science research criticised as not being high level evidence (Blackman, Wistow, & Byrne, 2013). Yet, social science studies help to provide understanding of issues in a specific context. It is often not the average that is important but what explains "*these highs and the lows"* (Ovretveit, 2009, p. 1732). The previously mentioned work of Townsend (2013) in relation to large-N studies within safety obscuring local level results reflects a similar view (Section 2.7).

It should be noted that this is not an argument for abandoning EBM. It is more a call to recognise that not all health care problems can be solved through such reductionist approaches to research where clinical work is reduced to an activity or task with cost containment being the driver (Martin & Sturmberg, 2009). Subsequently reports urging for the use of qualitative research as evidence to inform public policy have emerged that further add to this argument (National Research Council, 2012).

Evidence based medicine (EBM) is therefore considered flawed in situations that exhibit complexity. It is considered that it does not acknowledge whole of systems approaches, where both simple and complex interventions do not always work as expected nor can they be explained by such an approach (Martin & Sturmberg, 2009).

Whilst appropriate for cause and effect interventions for many areas of research, it is arguable that more is required in some situations. For example, some argue there is a need to explore *"how to research complex clinical conducts and experiences in the interest of limiting the risks and harm inflicted on patients and clinicians alike"* (Iedema, 2009, p. 1703). For this to occur, methods need to be developed that allow for the research of scenarios relevant to the reality of the real world (Blackman et al., 2013). This also requires a paradigm shift to one that better represents a more complex reality (Martin & Félix-Bortolotti, 2010).

3.3 Complexity, organisations and safety

Complexity science offers an alternative view to inform research. The theory emerged in the 1950's from the Santa Fe Institute where anthropologists studying civilisations noticed that many successful ones came to an abrupt end rather than experiencing a slow decline, suggesting a single catastrophic event may have been responsible (Lewin, 1999). Theorists were interested in the complexity of such cultures, similarities of events leading to their end and the concept that civilisations were more complex than linear. Further work involving computing science developed theories based upon the concept of the world being chaotic but within the chaos elements emerge through adapting (Lewin, 1999). Numerous disciplines have since adopted complexity theory including meteorology, physics, mathematics and genetics (McMillan, 2008; Mitchell, 2009). Theories of complexity challenge the nature of cause and effect thinking.

Central to complexity theory is the concept of a system which has been defined as a *"delineated part of the universe which is distinguished from the rest by an imaginary boundary"* (Martin & Félix-Bortolotti, 2010, p 417). Whilst Aristotle considered that *the whole is greater than the sum of the parts* (Martin & Sturmberg, 2009), systems thinking sees the *whole* as interconnected, interacting and interdependent parts (De Simone, 2006). The focus on the *whole* is considered more meaningful through the study of complexity as it focuses on determining how the *whole* exists through how the parts are organised whereas reductionism focuses on single cause and effect or interventions (De Simone, 2006). Through understanding the complex relationships and patterns of the *whole* it is therefore possible to understand the system (Anderson et al., 2005).

As noted in the previous section, this is not an argument that EBM should be abandoned. Indeed, it should be noted that complexity science does not dismiss evidence based approaches (De Simone, 2006) and it is acknowledged that such reductivism may be useful for the mechanical aspects of medicine (Sturmberg & Martin, 2009). However, for complex technical systems such as health care to be effective there is a need to understand heterogeneity (Martin & Félix-Bortolotti, 2010).

An awareness of complexity may not solve a problem but opens it up to a greater awareness through improving the understanding of complex relationships within the system as opposed to merely considering the relationship of discreet elements (Martin & Sturmberg, 2009). Therefore, approaching research from the perspective of complexity science allows for finding out how an organisation learns rather than what it knows (Anderson et al., 2005).

There are several features present in complex systems. They are made up of individual components and networks that exhibit collective behaviour, information is processed from both the internal and external environment and they are able to adapt (Mitchell, 2009). That is, the behaviour within the system is hard to predict but can change through learning or evolution in order to improve the possibility of survival or success (Mitchell, 2009).

Complex systems are also autonomous in that what they become is part of the system where the components within the surrounding environment may impact (Byrne, 2011). These multiplied relationships result in the potential for new states through adaption, that is, the system is *open* (Byrne, 2011; Dekker, 2011).

Systems may be described as simple or complex (Byrne, 2011). A simple system exists where a single cause can be determined and a causal category can be segregated from another. By comparison a complex system has causal categories that are intertwined and cannot be completely described in such a dualistic manner. One system may intersect with another or be nested within it and the boundaries may be fuzzy.

These concepts can be applied to complex organisations and they assist in explaining the nature of serious organisational failure. Systems can become resilient and are also able to adapt, which means they may not ever be fully describable (Dekker, 2011). Rather than describing the 'whole' as the sum of its parts, it is considered that the 'whole' has *emergent* parts (Dekker, 2011; McMillan, 2008). This emergence cannot be understood by analysis alone (Byrne, 2011).

Complexity has been described as a subset of chaos. It is from chaos that *emergence* comes which may include *"something that you couldn't have predicted from what you know of the component parts"* (Langton cited in Lewin, 1999, pp. 12—13). The emergent global structure influences behaviour at the local level which then feeds back to the global structure in a way that produces further influences.

It has been observed that in the traditional model which is based upon Newtonian science, something must break in order to indicate failure (Dekker, 2011). This reliance upon a Newtonian view of the world is problematic as it fails to recognise complexity. Complex systems are dynamic and non-linear, and the system may be robust enough to sustain the change (Byrne, 2011) or a small change may have a significant impact (Dekker, 2011; McMillan, 2008).

The notion of small changes having an impact is often referred to as the *butterfly effect*, a term that has its origins in a model for meteorology that considered whether the wing flap of a butterfly could cause a tornado. The conclusion was the single event of a butterfly flapping its wings could lead to a tornado depending upon what other elements were present in the weather system at the time (Lorenz, 1972).

Behaviour within an organisation emerges from the bottom up rather than top down and through adaption results in systems that develop a capacity to function at maximum capability. This is termed the *edge of chaos* (Dekker, 2011; McMillan, 2008). That is, the organisation (system) may appear to be chaotic but those working within it have adapted to form complex ways of operating. Hence, when the equivalent of a butterfly flapping its wings occurs there may be no effect, or the outcome may be extremely dramatic.

Once this point is reached there is a risk that a *phase shift* may result (Dekker, 2011). Other terms such as a *phase transit* or *tipping point* have also been used to describe this concept which refers to a little bit more or less of something leading to something very different. An example of such a process from the physical sciences is the impact temperature on an object's solid, liquid or gaseous form (Lewin, 1999).

For example, although possible temperatures have a large range, H_2O changes its form from solid to liquid and from liquid to gas at a specific temperature. A cup of water remains liquid even with a shift in temperature from 20—90 degrees but a small change from 95—100 degrees results in a significant change of form. When a phase shift or tipping point occurs within an organisation operating at the *edge of chaos* it is possible for a major system (or organisational) failure or disaster to occur (Dekker, 2011).

This view of how organisations fail has similarities with the *Swiss Cheese Model* referred to in the previous chapter (Reason, 1997). A latent error, for example, may be the eventual tipping point for a major incident. However, the nature of such a model is linear in that it may explain the events leading up to an organisational failure but the result of this type of thinking is to react to error and the constant measurement of the absence of safety rather than its presence (Hollnagel, 2014). It is possible that the focus on measurement of error is an unintended consequence of a focus on cause and effect approaches to error management and research.

It has been noted in the previous chapter that the concept of *resilience engineering* may offer an alternative approach to error management in complex-technical systems (Qureshi, 2007). Complexity, resilience and an acknowledgment of adaptive systems are underlying elements of this concept.

Focusing on the measurement of error, (the non-presence of safety) is referred to as *Safety I.* The alternative approach is *Safety II* where the focus is on what has gone right. When things in an organisation continually go right the organisation is considered *resilient.* Even when things do go wrong (that is, an error occurs) an organisation may be able to deal with the error and adapt in such a way that it continues to exist. This is further indication of *resilience.* Therefore, in order to understand how safety exists, there is a need to understand how organisations are resilient.

Organisations or systems that are continually resilient and that achieve greater levels of successful performance have been referred to as *positive deviants* (Lawton, Taylor, Clay-Williams, & Braithwaite, 2014). It has been proposed that a better understanding of safety may be achieved through identifying these, studying them in-depth to find the processes and practices that allow them to succeed (using qualitative methods), developing and testing findings in larger statistical studies followed by working with key stakeholders to "*disseminate the evidence about newly characterized best practices*" (Lawton et al., 2014 p. 881).

The focus of such an approach still hinges on the concept of *evidence* and large statistical studies that focus on intervention and outcome rather than complexity. The authors note that measuring concepts such as *safe care* is difficult as there is often variation found in measures amongst different work settings and professions (Lawton et al., 2014). Such differences in relation to medication error and safety climate have already been outlined in the previous chapter.

The challenge is how to better understand the complex health system, the sub-systems within it and how best to undertake research that is able to inform practice. Despite arguments that paradigms of knowledge generation need to reflect reality (Martin & Félix-Bortolotti, 2010) there is resistance to such change (De Simone, 2006). These types of statements assume an understanding of what constitutes *knowledge*. This will be explored further in the next section in relation to how knowledge is generated in a health care system that is complex.

3.4 Health care as a complex system

The previously cited *To Err is Human* proposed the need for a systems approach to health care error (Kohn et al., 2000). In order to take a systems approach to error management it is important to understand the health system as complex in the first place. It is also necessary to understand how different research methods can contribute to the understanding of that complexity.

Just as the terms *error* and *culture* are difficult to define so too is the term *knowledge.* Whilst the current tendency is to see knowledge as a state of fixity, of retrievable information, or meanings focused upon evidence, authority or expertise with a degree of certainty the word has its origins in a verb meaning *to knowledge* (Bennett et al., 2005). Philosophers sought to question and to actively seek knowledge rather than having a pre-occupation with certainty.

A similar contrast can be made between EBM and complexity science. The evidence-based approach focuses on certainty whilst complexity science focuses on understanding. As a result, there are differences in the way research is undertaken, the types of methods that may be used and the way in which theory is developed.

This contrast has been outlined in a model of knowledge generation through a view of the complex health system (Martin & Félix-Bortolotti, 2010). As noted earlier, a system may have other systems nested within it (Byrne, 2011; Dekker & Leveson, 2014). Through accepting health care as a complex system it is therefore possible to consider different ways of understanding it.

Knowledge generation in health care is informed through two approaches, *simple/complicated* and *complex/chaotic* (Byrne, 2011; Martin & Félix-Bortolotti, 2010). The former uses the cause and effect evidence-based approach previously outlined in this chapter. As a result *evidence* is informed by research that assumes both objectivity and linearity deemed to have both a high degree of certainty and agreement (Martin & Félix-Bortolotti, 2010).

The latter concept of *complex/chaotic* knowledge generation is informed by *sense-making*. Informed by complexity science *sense-making* assumes non-linearity and uses research for retrospective understanding although it is regarded there is less agreement and certainty from this research (Martin & Félix-Bortolotti, 2010).

Knowledge generation in a complex health system can therefore be informed by both *simple/complicated* and *complex/chaotic* approaches to research. It could be that a *simple/complicated* knowledge needs context or that a complex system may have either a complex or linear component. This results in *evidence, knowledge* and *sense-making* informing the *edge of chaos* that exists within the complex health system (Martin & Félix-Bortolotti, 2010).

In relation to improving knowledge of patient safety within the complex-technical health system the *Safety I* approach seeks evidence of the cause of error. More specifically in relation to medication error, safety climate would be considered an intervention to reduce the occurrence of error or to improve error reporting. In doing so, *evidence* is sought as to whether or not there is a relationship between the two. However, as outlined in the previous chapter, workplace setting, work role and other elements influence both safety climate and medication error. Differences have also been found in these elements and the relationship between the two.

The alternative *Safety II* approach aims to determine how a system or organisation may be *resilient.* Safety is viewed from a socio-cultural perspective which accepts complexity and attempts to understand it through *sense-making* (Martin & Félix-Bortolotti, 2010). Research applied to safety climate and medication error through this approach would be focussed on a retrospective understanding of that complexity.

Theory is also developed through either *deductive* or *inductive* means (Bryman, 2012; Ragin, 1987; Ragin & Amoroso, 2011). The formation of a hypothesis followed by data collection and analysis to test the hypothesis is to inform theory through *deductive* means. In contrast, to obtain data and undertake analysis is to undertake *inductive* theory development. The approach of EBM is to assume a system is *simple/complicated* and to use *deductive* reasoning in theory development whereas complexity science tends to use an *inductive* approach to understand a *complex/chaotic* system (Martin & Félix-Bortolotti, 2010).

This raises the issue of which is the best approach to undertake for this research. It also leads to a need to consider an appropriate method for such a task.

3.5 Researching the complex health system

Research involving the complex and dynamic health system requires a method used that acknowledges complexity. There are numerous debates present in the literature regarding how to achieve this in relation to researching patient safety and complexity. The dominant debate within health care is focused on a comparison between quantitative and qualitative approaches for patient safety research. Meanwhile a debate within social sciences surrounding the benefits of case-based comparative research offers an opportunity to introduce a new means of research to contribute to knowledge generation for the complex system of health care.

Social science research has been put forward as offering promise in researching both systems and patient safety. Examples of how it may be used include reframing problems and offering a different way of viewing them, particularly in relation to the implementation of change (Ovretveit, 2009). That is, it may be possible to show how a system may be changing (Runciman, 2002).

It has already been identified in the previous section that EBM embeds the notion of cause and effect through focusing on interventions and outcomes. However, as also outlined in the previous section it is not the only way in which knowledge may be generated. Knowledge may also be informed through an improved understanding of complexity, although how to research this remains a challenge.

People are influenced by context and as a result do not always do as they are supposed to, the question remaining is *why* (Ovretveit, 2009). In addition, clinical practice is dominated by management and data whilst questions remain unanswered in relation to how clinicians work with the socio- and psycho-social aspects of both patient safety and their own safety (Vincent, 2009). It has been suggested that questions such as why health care workers are reluctant to report or disclose error openly when there is a policy to do so may be answered by social science frameworks of analysis rather than merely through checklists and evidence based medicine (Ovretveit, 2009).

Central to EBM is the nature of interventions (cause) to achieve a specific outcome (effect). Although *complexity science* recognises the potential for a broader understanding of complex systems, social science theorists have postulated the notion of causality within such complexity.

The problem with social science data is that it tends to be *noisy* (Schneider & Wagemann, 2012). That is, real world data do not always clearly fit a particular causal path and therefore it is not always possible to clearly identify causal elements in relation to an outcome. This reflects complexity.

The use of configurational comparative methods (CCM) offers an opportunity to study such noisy data in a transparent and structured manner. While the details of how this approach has been used for this research appears in the next chapter, an overview of some of the key concepts of CCM is necessary here to demonstrate how such methods have the potential to contribute to knowledge generation and improved understanding of the complexity between safety climate, error reporting and error disclosure.

3.6 Configurational comparative methods

One of the problems noted regarding the ability to research complexity is the failure to develop methods that allow the research of scenarios relevant to the reality of the real world (Blackman et al., 2013). Configurational comparative methods offer an opportunity to address this issue and it has been suggested that they could be applied to researching hospital error and in particular examine unusual cases in order to develop better understanding of the underlying complexity which may then assist in improving error management (Bell, 2007).

The term CCM generally refers to a group of methods. For the purposes of this research the term will be used in reference to the associated with the two most common set-theoretic methods of crisp and fuzzy set qualitative comparative analysis (csQCA and fsQCA). When discussing the detail in relation to analysis using each of these methods reference will be made to the particular form of QCA being used. This clear differentiation between terminology relating to research design and the process of analysis is to clearly separate the two and to assist in avoiding confusion which may occur if the terms are used interchangeably.

These methods use comparative approaches to study diversity as opposed to qualitative approaches which are used to study commonality and quantitative approaches used to study covariance (Ragin, 1987; Ragin & Amoroso, 2011). They are also case-based.

There are a variety of ways in which *case* research is applied. Cases may be a theoretical construct or identified through empirical units (Ragin, 1992). Ultimately, it is important for a researcher to clearly indicate what a case is “of” (Luck et al., 2006).

Configurational comparative methods study cases by considering configurations of the presence (or absence) of conditions of interest and determines those which may be causal for the presence (or absence) of an outcome (Ragin & Amoroso, 2011). Hence, use of the term *configurational comparative methods.* The mathematical underpinnings of these methods reside in fuzzy set theory leading to them also being referred to as *set theoretic methods.*

These methods contrast with both quantitative and qualitative methods (Ragin, 1987). Quantitative research emphasises the relationship between different variables, whereas configurational methods focus upon the cases themselves and how the conditions of interest relate to each case. Qualitative research focuses on identifying variables or conditions but how their presence or absence impacts upon a particular outcome on a case-by-case basis is not understood. It is possible to understand this impact through a CCM approach.

Central to CCMs are the concepts of *conjunctural causality* and *equifinality.* The intersection of more than one factor (that is a configuration of conditions) leading to an outcome is referred to as *conjunctural causality* (Ragin, 1987). That is, a single element alone does not cause an outcome but the outcome is the result of that element acting with other factors (Schneider & Wagemann, 2012). The term *equifinality* refers to the possibility that more than one configuration (that is alternative configurations of the same conditions) may also lead to the same outcome (Schneider & Wagemann, 2012).

There are several ways that CCM may be used for research. These include summarising data, checking data coherence, checking a hypothesis or existing theory, testing conjecture and for developing new theoretical arguments. Analysis with CCM leads to the researcher moving between *inductive* and *deductive* reasoning. This process is termed *retroduction* (Ragin & Amoroso, 2011).

Configurational comparative methods are valuable for understanding context, interactions and causal complexity (Collier, 2014). This makes them useful for researching the complexity of patient safety within health care.

A systems approach to patient safety is about enhancing the capacity for those who work within the system to do the right thing through more than just standardised approaches such as checklists but recognising that behaviour is influenced by context (Dekker & Leveson, 2014). The literature review presented in the previous chapter identified a possible influence of workplace setting, work role and other elements upon safety climate, error reporting and disclosure. Each of these is an example of how context may influence behaviour.

Current approaches to research have merely identified these issues that exist, with no capacity to understand how they impact upon the individual clinician whose behaviour in doing the right thing is crucial to the delivery of safe patient care. Configurational comparative methods therefore offer an opportunity to fill this gap in how knowledge is formed in relation to the way clinicians think and behave.

Causal relationships may work differently in different contexts (Denk & Lehtinen, 2013). Therefore the use of CCM for this research may assist in understanding why different workplace settings or work roles show differences relating to safety climate, error and disclosure.

It is the configurations of the conditions of each case that matter, specific to that case (Denk & Lehtinen, 2013). It is often unusual cases or *outliers* that provide new information in health care (Runciman, 2002). The use of configurational comparative methods allows for the identification of different states of a similar system that enables the researcher to look at the cases that are of interest, whether that be in relation to a particular outcome or the identification and examination of those cases that are unusual.

3.6.1 Focus on effectality

Arguments have also been put forward of a need for greater focus on the nature of effect as much as that of causality. This is termed *effectality* and it is achieved through thinking about the actions needed towards the achievement of a desired outcome rather than actions as a cause of what has happened. Such an approach is considered *retroductive* (Byrne, 2011).

Four types of *effectality* have been defined with respect to a system. These are the specifying of the original position (the nature of the space when it came into existence), staying the same (whilst some aspects may change the system remains the same), undergoing phase shift (although the system remains there is a change in its character) and terminating (whereby the system ceases to exist in any form and loses its inherent integrity) (Byrne, 2011).

Evidence based medicine tends to promote deductive reasoning using quantitative methods and is useful for researching simple/complicated systems. In contrast complexity science leans towards a more inductive approach using qualitative methods to assist understanding a complex/chaotic system. Through use of a CCM the recognition of *effectality* and approaches to more inductive theory development may also be a means of adding knowledge and understanding of complexity within health care settings.

The use of CCM is growing. Two reviews have found increasing numbers of studies in a variety of disciplines including health (Rihoux & Marx, 2013; Thiem & Dusa, 2013). Publications have increased substantially in the past ten years with greatest growth occurring in the more developed analysis of fuzzy set QCA (*fsQCA).*

An example of the use of CCM for health care research is an analysis undertaken with respect to conditions observed for the successful implementation of a smoking cessation program. This research specifically looked at the conditions present amongst the individuals who participated in the program who ceased smoking. This study determined that whilst education was a required condition, in all cases where an individual ceased smoking access to employment opportunities and housing were conditions that were also needed to be present for the desired outcome (Blackman, 2008).

Without these additional conditions as well as the education provided with the program there was no success for individuals who participated in the smoking cessation program. That is, the research considered each condition with respect to the individual case, rather than comparing the relationship between variables and as a result was able to establish which elements were required for individuals to succeed and cease smoking. These methods have also been used in organisational studies. It has been suggested that as organisational parts are inter-connected then configurational approaches to research are appropriate (Ragin, 2013).

An example from organisational research found that managers with transformational leadership characteristics were likely to successfully implement change within an organisation. However, through the use of CCM it was also identified that in the absence of such a leadership style the same achievement was possible through a combination of other characteristics by a leader (Whittington & Goodwin, 2013).

These examples demonstrate the use of CCM to generate knowledge of complexity. In addition, they are examples of the use of CCM within both health care and organisational research.

Therefore use of CCM shows promise in order to understand the complexity of safety climate, error reporting and disclosure. Having established this, it is necessary to now consider the development of research sub-questions to inform the overall research question and research aims of this research. Once this has been undertaken it is possible to discuss in detail how CCM may be used for this research. This discussion will be presented in the following chapter.

3.7 The complexity of safety climate and the reporting and disclosure of medication error

There are several matters that suggest the use of a configurational comparative method to research the complexity of safety climate and views of reporting and disclosure of medication error. Firstly, it has been identified in the previous chapter that the health system is undergoing constant change (Section 2.3). That is, it is not a static system. Secondly, the nature of the relationship between safety climate, reporting and disclosure is complex with differences found amongst different workplace settings and work roles (Section 2.16).

Complexity science recognises each of these. There is an acknowledgment that systems are dynamic and changing (Lewin, 1999; Mitchell, 2009). There is also recognition that organisations adapt to the constantly changing environment (Dekker, 2011; McMillan, 2008). Some of these complex adaptive systems perform at a high level within that complexity and are resilient to change (Hollnagel, 2014).

Patient safety, including medication error, is a serious problem for the health system (Australian Commission for Safety and Quality in Health Care, 2013b). However, the majority of care that consumers or patients receive is safely delivered without incident or harm (Hollnagel et al., 2013). In order to better manage safety and ensure safe patient care it is necessary to improve understanding of episodes of safe care.

Therefore to achieve the aim of this research which is to *describe the complexity of safety climate of nurses working in rural clinical settings,* the use of a complexity science framework is more suitable than one based upon cause-effect science.

Configurational methods assist in the identification of causal complexity (*conjunctural causality*) (Ragin, 1987; Schneider & Wagemann, 2012). They also recognise more than one causal pathway may be present for a specific outcome. Thus, use of a configurational comparative method would be beneficial for this research through informing the research aim and contributing to knowledge of the complex health system through providing sense-making of how safety climate is related to views of reporting and disclosure of error.

3.7.1 Development of 4th and 5th research sub-questions

It has been noted that simple/complicated approaches to research assist in identifying difference but do not explain them (Ragin & Amoroso, 2011). For this research method acknowledging complexity is required and this may be addressed by the use of CCM. Therefore, CCM may assist in informing the main research question of *how is safety climate related to views of reporting and disclosure of medication error amongst nurses working in rural clinical settings?*

What is not so clear is how this may be achieved. Therefore a fourth research sub-question for this research is: *how is the understanding of the relationship between workplace safety climate and views of reporting medication error changed through the use of a configurational comparative method?* That is, if a CCM approach is used for this research there is a need to identify how it contributes to generating knowledge of the complex health care system.

This research sub-question assumes use of CCM will lead to a change of understanding through this contribution to knowledge. Once this change is identified there are implications in relation to the main research question.

That is, if the understanding of how safety climate is related to nurses' views of reporting and disclosure of medication error is changed then there may be implication for both the management of medication as well as medication error. Therefore a fifth research sub-question for this research is: w*hat could this mean for the management of medication error?*

With the research aim, question and sub-questions established, the following chapter will provide more detail of how a configurational comparative method has been used for this research.

4 Research design and method

Safety and error are complex areas. Organisations are complex in terms of how they operate hence understanding what should be done to ensure that safe patient care occurs is difficult to research. However, there is still much that is unknown about how complex organisations work.

It has been suggested that a shift in focus is needed away from concentrating on what has gone wrong in a few cases (*Safety I*) to what has gone right in most cases (*Safety II*) (Hollnagel, 2014). This means a greater focus upon understanding how some organisations develop the capacity to ensure what should happen does. Those that achieve this are regarded as *resilient.*

Complexity science is emerging as a paradigm for a better understanding of how organisations work in respect to organisational culture and safety. Rather than focusing on *evidence*, complexity science acknowledges the need for *sense-making* and recognises that different things work in different settings and situations (Martin & Félix-Bortolotti, 2010).

The aim of this research is to *describe the complexity of safety climate of nurses working in rural clinical settings.* This aim was developed through examination of the literature in relation to safety climate and error reporting and disclosure, and will be informed through the research question which is *how is safety climate related to views of reporting and disclosure of medication error amongst nurses working in rural clinical settings?*

The notion of complexity is central to CCM and therefore such methods offer an innovative means for the future research of organisational complexity. Through case-based analysis of sub-set relations it is possible to consider a variety of conditions and their impact on a particular outcome (Ragin, 1987; Rihoux & Ragin, 2009; Schneider & Wagemann, 2012). In using this approach it is possible to identify more than one set of conditions that may lead to an outcome, or several similar sets of conditions that may lead to very different outcomes which reflects the key concepts of *conjunctural causality* and *equifinality* (Schneider & Wagemann, 2012).

There is a growing number of studies where a CCM research design has been applied (Rihoux & Marx, 2013; Thiem & Dusa, 2013). This includes publications of applications of a CCM in high ranking journals, including one recently (Trujillo & Woulfin, 2014).

The potential for use of CCM in researching the complexity in health care was introduced in the previous chapter. For this research it has been used for the summarising of data as well as for theory development (Berg-Schlosser et al., 2009). Further details about the specific research design that has been applied to this research and the methods of analysis will now be outlined in in this chapter.

The research design is based upon the *funnel of complexity* which outlines three phases that should be undertaken when applying a CCM research design (Rihoux & Lobe, 2009). Detail of this how this process has been applied to this research is presented in Figure 4-1.

The first of these phases is *before the analytic moment* where theory and case knowledge informs the research (Rihoux & Lobe, 2009; Schneider & Wagemann, 2010). The detail of the research design, data collection and preparation of research data for analysis using a CCM will also be presented in this section. This includes the selection of cases as well as the conditions and outcomes of interest for the research.

It is recommended that another form of analysis be used alongside CCM (Schneider & Wagemann, 2010). Therefore a variable-based analysis using principal components analysis (PCA) and inferential statistics was undertaken. Use of each of these approaches assisted in addressing the first three research sub-questions with the former also adopted as a means of determining the conditions for analysis using fsQCA. More detail of how these analyses were used will also be outlined in this chapter.

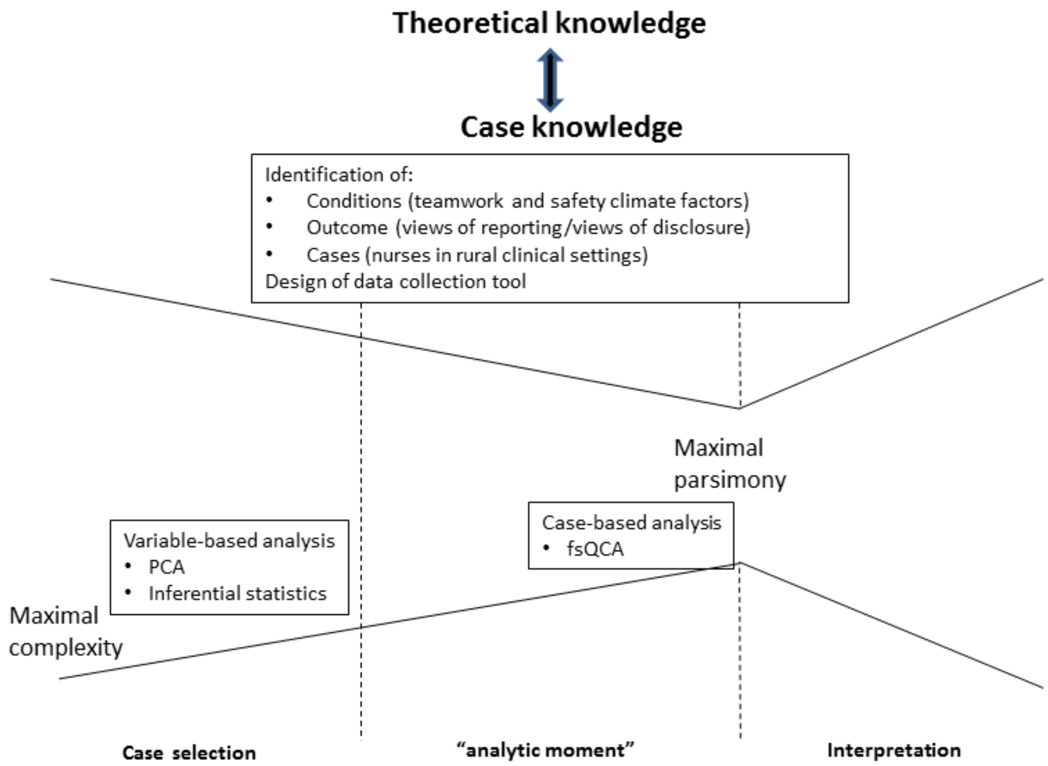

Figure 4-1: Funnel of complexity as applied in this research (adapted from Rihoux & Lobe, 2009)

Once this has been presented the second phase *during the analytic moment* will be outlined (Rihoux & Lobe, 2009). Analysis of case-based data will be explained including the preparation of data through *calibration* of sets, use of Boolean algebra and software, and production of solution terms (Berg-Schlosser & De Meur, 2009; Schneider & Wagemann, 2010, 2012). Definitions and explanations of these and other key terms for analysis of *necessary* and *sufficient* conditions, the production of a *truth table*, discussion of truth table analysis and handling of *contradictions* and *logical remainders* will also be provided.

This research involves the comparison of several different outcomes. Outlined in this chapter is the consistent and transparent approach to analysis that has been developed to allow comparison between these different outcomes.

Following the analysis the third phase *after the analytic moment* occurs. During this phase results from the analysis will be presented and discussed in terms of how they inform existing case and theoretical knowledge. This final phase will be mostly undertaken in the following chapters, however an outline of how results will be presented is provided at the end of this chapter.

The recommended set of *standards of good practice* have also been used to inform this research (Schneider & Wagemann, 2010). These provide a guide to the researcher as to how to undertake configurational methods.

Theoretical knowledge has underpinned the aims of this research. The research sub-questions also reflect both theoretical and case knowledge and inform the outcome, conditions and cases that will be used for analysis using fuzzy set qualitative comparative analysis (*fsQCA).* Before the research design is discussed an overview of analysis with CCM is required.

4.1.1 Overview of CCM analysis

Configurational comparative methods are used to research the complexity of configurations of conditions of interest and the presence or absence of a particular outcome of interest (Berg-Schlosser et al., 2009; Ragin, 1987, 1992; Ragin & Amoroso, 2011; Schneider & Wagemann, 2012). These approaches have their foundations in fuzzy set theory and are also referred to as *set-theoretic* as they allow for the study of sub-set relations (Berg-Schlosser & De Meur, 2009; Schneider & Wagemann, 2012). An *outcome* is the main focus of a study, the variable to be explained by conditions (Rihoux & Ragin, 2009) or the phenomenon of interest (Schneider & Wagemann, 2012). A *condition* is described as something that may affect an outcome (Rihoux & Ragin, 2009) or may explain it (Schneider & Wagemann, 2012).

That is, within a given data set there are two sub-sets. One is the set of cases where the outcome of interest is present and the other is the set of cases where the outcome is not present. The cases in each of these sub-sets are studied with consideration as to whether configurations of conditions of interest are present or absent.

There are different forms of CCM. The two most common are crisp set qualitative comparative analysis (*csQCA*) and fuzzy set qualitative comparative analysis (*fsQCA*) (Rihoux & Marx, 2013; Thiem & Dusa, 2013). The detail of how each has been applied in relation to this research appears later in this chapter. First, it is important consider the different approaches to analysis in order to assist in understanding the nature of CCM research design.

To undertake an analysis using *csQCA* or *fsQCA* data needs to be transformed or *calibrated* (Ragin, 2009; Schneider & Wagemann, 2010, 2012). Each of these methods of analysis differ in approaches to *calibration* and this will be explained here.

Crisp set QCA (csQCA) is the approach used when the set membership of the conditions and outcome are dichotomised (Marx, Cambre, & Rihoux, 2013; Rihoux & De Meur, 2009) That is, it is determined that the cases are contained in the set of the condition or outcome (*fully in*) or they are not (*fully out*). The terminology used to indicate each is *True* or *1* for *fully in* and *False* or *0* for *fully out*. Fuzzy set QCA (fsQCA) allocates cases to set membership by degrees rather than by dichotomisation (Greckhamer et al., 2013; Ragin, 2009; Schneider & Wagemann, 2012). Hence, rather than be classified "fully in" or "fully out" the classification can be by degrees on a range from 0 (fully out) to 1 (fully in). Sets are thus *calibrated* to reflect the degrees. A *crossover point* is set as the point at which a condition or outcome is considered neither in nor out of the set. Thus cases can then be assigned set membership by degrees. This point, which is within the range of *0—1*, is set as *0.5* (Ragin, 2009; Schneider & Wagemann, 2012).

This may seem somewhat confusing when explained in isolation but applying it to an example assists in understanding. If it was necessary to determine set membership of the set *Red Squares*, then a red square may be considered *fully in (1)* and a blue circle *fully out (0)*. If there were four cases present, these being a red square, a blue square, a red circle and a blue circle, then a red square could easily be assigned as *fully in (1)* and any other cases present, regardless of shape or colour would be assigned *fully out (0)*.

The approach taken with *csQCA* only allows for the choice of considering each case as either *fully in (1)* or *fully out (0)* (Ragin, 2009; Schneider & Wagemann, 2012). By adopting an *fsQCA* approach it is possible to consider that cases may be *partially in* a given set.

Thus, in the example of the set of *Red Squares,* if a researcher was more interested in cases based upon shape rather than colour then for the condition of *red* or *square* was present then they may assign a value of *0.75* to the blue square and a value of *0* to the red circle to reflect that the condition of interest *square* was more present in the blue square. In this instance the respective shape with the calibrated value of *0.75* would be considered *partially in* the set of red squares, indicated by a *calibration* of above *0.5* but less than *1*. With this approach to set calibration the diversity of cases can be accommodated.

Decisions around set calibration and membership need to be transparent and based upon theory and research (Ragin, 2008; Schneider & Wagemann, 2010, 2012). That is, when calibrating set membership of cases for a given set the researcher needs to justify any decisions regarding how cases are assigned.

As noted in the previous chapter, when the neat world of science meets the reality of society and social science that data can become *noisy* (Schneider & Wagemann, 2012). This noise reflects the nature of the *complex/chaotic* world and hence a method that allows the nature of chaos to be reflected in the way data can be analysed is useful in aiding the understanding of complexity. The ability to calibrate by degrees in *fsQCA,* when compared to the crisp set approach of a set being either '*fully in'* or '*fully out'*, has resulted in growing use of this approach (Rihoux & Marx, 2013; Thiem & Dusa, 2013).

Having determined *fsQCA* as the analysis approach for this research, further detail will now be presented regarding the research design, including selection of cases as well as detail of conditions and outcome of interest. The specifics of how sets were calibrated will be provided later in this chapter. Included is reference to several of the sub-questions which also reflect theoretical knowledge informing the research design with regards to the selection of outcomes, conditions and cases that underpinned the analysis with *fsQCA.*

4.2 Theoretical and case knowledge informing conditions, outcome and cases.

During the first phase of the *funnel of complexity* theoretical and case knowledge should be used to develop the research design (Rihoux & Lobe, 2009). In this *before the analytic moment* phase of the research design, the conditions, outcome and cases should therefore be informed by theoretical and case knowledge.

Configurational comparative methods should not be used for anything other than their original aims of understanding complexity (Ragin, 2009; Rihoux & Lobe, 2009; Schneider & Wagemann, 2010, 2012). To ensure these aims are met there needs to be transparent justification surrounding selection of cases, conditions and outcomes, the use of appropriate terminology and a detailed discussion surrounding the assignment of set membership scores (Berg-Schlosser & De Meur, 2009; Schneider & Wagemann, 2010).

It has already been highlighted that the aims and research question of this research have been developed from theory and existing research, as outlined in the literature review. More detail regarding how some of the research sub-questions have further ensured the use of theory in the development of the research design will now be provided.

The first of these research sub-questions is: *what level of reporting and disclosure of different severity of a hypothetical medication error do nurses in rural clinical settings think is occurring?* This sub-question was developed through consideration of the literature. Little research is available surrounding reporting and disclosure of error in rural clinical settings (Aranaz-Andrés et al., 2011; Jones et al., 2008; Wholey et al., 2004)(Section 2.12). In addition, the involvement of nurses in error disclosure is not well researched (Harrison et al., 2014).

Similar issues were identified in relation to safety culture and more particularly safety climate. This resulted in the development of a second research sub-question which is: *what is the nature of workplace safety climate amongst nurses in these settings?*

In both instances differences were noted amongst different workplace settings and work roles as well as other elements such as experience and issues such as burnout. Current research has focused upon the identification and measurement of such differences but not upon understanding them.

The conflicting information provided in the t literature makes it difficult to determine if there is a relationship between safety climate and the reporting and disclosure of error. Although some studies suggest there is a relationship (Colla et al., 2005; Hutchinson et al., 2009) others suggest there may not be (Freeth et al., 2012; Groves, 2014). In addition, in relation to rural clinical settings there are no known studies of this relationship.

In order to address the first two research sub-questions frequency data are required. As noted in the literature review existing studies have adopted the approach of asking participants their reporting and disclosure habits (Haw et al., 2014; Kagan & Barnoy, 2008) or they have observed them (Bayazidi et al., 2012;

Westbrook et al., 2015). For this reason the use of a statistical approach with CCM, was required, particularly the use of inferential statistics.

In addition, safety climate is generally measured using questionnaires which have the capacity to reduce questions or items into groups or factors (Etchegaray, St. John, & Thomas, 2011; Freeth et al., 2012). For this reason principal components analysis (PCA) was also used for this research.

Therefore, whilst a variety of options to obtain data are available, use of a questionnaire would allow for collection of data in relation to both factors of safety climate and views of reporting and disclosure. Use of a hypothetical medication error could also be accommodated through this means.

Further detail regarding the development of a questionnaire is presented later in this chapter. Before this can be considered, more detail regarding the identification of outcomes, conditions and cases is required.

The third research sub-question is: *what is the relationship between workplace safety climate amongst nurses in rural clinical settings and their views of reporting/disclosure of a hypothetical medication error?* This sub-question compares the relationship between safety climate and views of reporting and disclosure of error. Recalling the debate outlined in the previous study regarding case and variable research (Ragin & Amoroso, 2011) it is possible that both approaches may be used for this research in order to address the third sub-question. That is, the relationship between safety climate and views of reporting and disclosure could be analysed using both a variable-based and case-based analysis.

In addition it is recommended that when undertaking *fsQCA* another form of analysis is used (Schneider & Wagemann, 2010). Therefore, use of inferential statistics to compare variables was possible alongside a case-based analysis of safety climate *conditions* analysed in relation to the *outcome* of views of reporting and disclosure of a hypothetical medication error also conducted. The use of both inferential statistics and PCA within a CCM research design assisted in obtaining and analysing data to address a further sub-question and therefore contribute to the findings relating to the research question and aims of this research.

With the *conditions* and *outcomes* informed by the research sub-questions a further step was required. The selection of cases needed to be informed by case and theoretical knowledge.

The aim of this research specifically refers to nurses in rural clinical settings as does the main research question and three sub-questions discussed thus far. The research aim, question and sub-questions were developed through reviewing both the context of patient safety and related research. Therefore theoretical and case knowledge has therefore informed the selection of cases.

The rationale for the focus upon nurses was also determined through the literature review. Nurses are actively involved in medication management (Choo et al., 2010). In addition, there is limited research involving nurses, including rural nurses, in the process of error disclosure (Harrison et al., 2014; O'Connor et al., 2010).

It is therefore clear that theoretical knowledge determined the *outcome* (views of reporting and disclosure), *conditions* (factors of teamwork and safety climate) and *cases* (nurses in rural clinical settings) for this research. Having done this it was then necessary to obtain data from the cases in relation to the outcome and conditions in a manner that allowed for transparent set *calibration.*

4.2.1 Questionnaire development

As outlined in the previous section, it was necessary to transparently obtain data for this research in relation to *conditions, outcome and cases.* A questionnaire was developed for this purpose and this will now be detailed.

The questionnaire contained three sections. The first obtained data relating to factors of safety climate, the second made use of a hypothetical scenario to obtain data regarding views of reporting and disclosure and the third section collected demographic information.

To enhance transparency and reduce researcher bias, for the first two sections existing tools were used. The *Safety Attitudes Questionnaire* (SAQ) (Sexton et al., 2006) was used for collecting data regarding the conditions and a hypothetical medication error used in a previous study allowed for data relating to the outcome to be obtained (Weissman et al., 2005). The section relating to demographic was developed based upon the type of data collected by the SAQ, differences identified through the literature review (Chapter 2) and the context in which the research was undertaken (Department of Health and Human Services, 2007; Sexton et al., 2006).

As noted in the literature review (Section 2.15) there are numerous tools available for collection of data relating to safety climate (Colla et al., 2005; Flin et al., 2006; Valentine et al., 2015). Three elements require attention when choosing a safety climate data collection instrument (Flin et al., 2006). These are *content validity, criterion related validity* and *factor analysis.*

Content validity refers to the nature of questions contained within the SAQ and whether or not they measure what is intended to be measured (Flin et al., 2006). Use of theory, expert judgment and available literature are means of determining *content validity* (Bryman, 2012).

One particular study undertaken in the UK adapted the language of the SAQ to suit the non-hospital primary care environment (Hutchinson et al., 2006). The settings of this previous research were similar to those of the present research in that they were outside the acute hospital environment. Therefore the same wording was used for this present research. For in the context of this research, theory therefore informed *content validity.*

The correlation of safety attitudes factor scores with outcome data is referred to as *criterion related validity* (Flin et al., 2006). The SAQ has been used in several studies in this respect (Colla et al., 2005; Hutchinson et al., 2009). Although the preference is to source information from something other than the data collection instrument it has been noted that self-reporting is often the only means available (Flin et al., 2006). Data regarding outcomes were collected from the same instrument for this research.

Factor analysis shows if the themes being measured can be distinguished (Flin et al., 2006). This approach has been used in prior studies with the SAQ (Hutchinson et al., 2006; Sexton et al., 2006). The term *factor analysis* is used to describe various ways in which a number of variables may be reduced to a smaller number of coherently grouped factors (Tabachnick & Fidell, 2007).

The term is often used interchangeably with that of *principal components analysis* (PCA). However, there is a subtle difference in that PCA is used to reduce the observed variables into components (Matsunaga, 2010). For this research the items in the SAQ were reduced to a set of factors for safety climate and teamwork. Therefore the term *principal components analysis* is used. Although this process identifies *components* rather than *factors,* it has been noted that the term *factors* may also be used to avoid confusion. Therefore, the term *factor* was used for this research. More detail regarding how this was analysis was conducted is presented in Section 4.3.3.

As much information as possible should be collected when using PCA (Matsunaga, 2010). For this reason the questionnaire used in the previously mentioned UK study (Hutchinson et al., 2006) was administered with use of all items including those not retained in the final factor structure identified by the previous study.

Organisations are considered hierarchical, therefore safety climate may be measured at the individual, work group, department or organisational level (Flin et al., 2006). Of the two most widely used surveys for safety climate, the SAQ and

HSOPSC, the former has been found to be more suitable for benchmarking and examining relationships with outcomes whereas the latter allows for unit- and institutional-level results (Etchegaray & Thomas, 2012).

As noted in Chapter 2 (Section 2.15) the SAQ is considered more reliable to assess safety climate across a whole health system (Etchegaray & Thomas, 2012). This supports the use of the SAQ for this research which was conducted to examine the relationship of safety climate with views of reporting and disclosure of error.

The second section of the questionnaire obtained data relating to these outcomes. A hypothetical medication error was used to collect data regarding the *outcome* of nurses' views of reporting and disclosure (Weissman et al., 2005). The use of a hypothetical scenario was considered a means to reduce the risk to participants in that they would be answering in relation to a hypothetical situation rather than being asked to respond to events that had occurred in their workplace that may or may not have been reported or disclosed.

The error constituted the prescribing of an antibiotic to which a patient had a known documented allergy and three outcomes of an allergic reaction with irreversible severe harm, a reaction that was treated and the patient recovered (moderate error) and a near miss error outcome where the patient had no reaction and after two days of receiving the medication the prescription was changed to another medication. The near miss scenario could also be considered a "no harm incident" in reference to definitions used in the Australian context (Australian Commission for Safety and Quality in Health Care, 2013a).

This scenario was adapted, with permission, from that of a previous study amongst hospital leaders in the US (Weissman et al., 2005). Adaptions of the scenario for this present research included use of the generic (non-brand) name for the medication prescribed and clarification that there were no allergy symptoms for the near miss outcome.

The *content validity* of this scenario was verified through the literature relating to medication error. Prescribing errors where there are known documented allergies occur in hospital, community and aged care settings (Australian Commission for Safety and Quality in Health Care, 2013b; Easton et al., 2009). As the prescribing of the medication was for a urinary tract infection, a condition that is common within hospitals and community settings in Australia, the scenario was considered suitable for use in this research (Jarvis, Chan, & Gottlieb, 2014).

It should be noted here that the error scenario relates to views of what nurses think is being reported or disclosed rather than what nurses themselves would report. In addition, it has already been highlighted in previous chapters that nurses often state they would report an error more than which they actually do report in practice (Section 2.10). Therefore, this present study may not be directly comparable to studies of actual reporting rates. Both these elements are considered in more detail in Chapter 3 (Section 6.1)

The final section of the questionnaire obtained information relating to the nurse respondents who made up the *cases* for this research. Demographic information obtained included, workplace setting, work role, experience in current role and experience working in nursing, and worksite postcode. Details of how questions were developed for each of these can be found in Appendix 5. As noted above, the SAQ is best used to collect data across a whole health system so its use in this research for the collection of the demographic data was appropriate as it allowed for a comparisons of safety climate and views of reporting and disclosure to be compared amongst different groups from within a whole health system.

It has already been identified in the literature review that differences in reporting, disclosure and safety climate have been found relating to workplace setting (Latif et al., 2013), work role (Hobgood, Weiner et al., 2006; Kagan & Barnoy, 2008; Kim et al., 2007; Morello et al., 2013) and experience (Chiang et al., 2010; Cole et al., 2013). Therefore work setting, work role and experience were included in demographic data collection.

Registration level, employment sector and facility size were also included as demographic items. Two levels of registration operate in Australia encompassing different roles in the administration of medications (Kerr, Lu, Mill, & McKinlay, 2012). It was considered there may therefore be different views associated with this.

The ACSQHC has also noted concerns regarding low response rates from non-government small rural hospitals to a survey they conducted relating to the new standards for accreditation (Australian Commission for Safety and Quality in Health Care, 2012b). This suggested it was worthwhile examining data based upon employment sector as well as facility size.

Postcode data were obtained in order to ensure responses were received from worksites in the locations of interest as well as allowing for data to be analysed in relation to the three regional health areas operating in Tasmania at the time of data collection (Department of Health and Human Services, 2007, 2015). The ASGC-RA locality was also determined by postcode (Australian Government, 2010). A table combining this information and appears in Appendix 5.

The demographic information collected was kept to a minimum and details regarding specific worksites were omitted. This was done to ensure nurses could not be identified despite the anonymous nature of the questionnaire. In addition, as the content of the research related to safety there were concerns that if data were analysed on a worksite-by-worksite basis there was potential for a particular facility to be labelled as "unsafe" if safety climate scores were found to be low.

4.2.2 Set calibration

With the data collection questionnaire finalised it was necessary to determine how the cases would be assigned to the *condition* and *outcome* sets through a transparent process of *calibration.* It is recommended that this process be discussed in detail (Schneider & Wagemann, 2010).

Whilst the name "*Qualitative Comparative Analysis"* suggests the method is qualitative this does not mean that only qualitative data may be analysed. Both numerical and non-numerical forms of data may be used with QCA (Ragin, 2009). The term *"qualitative"* is more applicable in the nature of the analysis itself than the data that is used (Schneider & Wagemann, 2012). Through applying a *qualitative descriptor* to a data set the method allows for data to be "described" (Schneider & Wagemann, 2012). Hence it was possible to use a questionnaire using quantitative data for this research.

The use of another form of analysis alongside *fsQCA* is also recommended (Schneider & Wagemann, 2010). The calibration of the data for *fsQCA* also determined which statistical tests were applied for this research. These are discussed in detail at a later stage in this chapter (Section 4.3).

When undertaking set calibration it is important to determine the *crossover point* (also referred to as the *cross-over* or *qualitative anchor*) (Ragin, 2008; Schneider & Wagemann, 2012). This is given the value of *0.5* and distinguishes the point at which a case may be neither in nor out of a set. Values also need to be set for *fully in* and *fully out.*

The SAQ was used for the purpose of obtaining data relating to the *conditions.* The importance of factor analysis has already been noted earlier and how it has been applied in this research will be discussed in more detail at a later stage. Through the use of this process it is possible to develop factor scores from the SAQ.

Once factors were identified a factor score was calculated. Items were allocated a score from 1-5 (*Agree Strongly = 5, Agree Slightly = 4, Neither Agree nor Disagree = 3, Disagree Slightly = 2, Disagree Strongly =1)* (University of Texas Health, 2015).

Following reversal of negatively worded items, the scores are then converted to a 100 point scale score using the formula:

*Teamwork Climate Scale Score for a Respondent = (((Mean of the items)-1) * 25)*

Guidelines relating to SAQ scores were used to assist calibration of the conditions set further (University of Texas Health, 2015). A score of 75 or higher is considered positive (University of Texas Health, 2015). The *crossover point* for set calibration was therefore set at a value of 74.999. This value ensured a case with a score of 75 or higher was allocated to be *fully in the set* of *positive factor score* (the qualitative descriptor) and a scores of 74.99 were considered *outside* the set.

The scores below 75 are "0", "25" and "50" representing initial values of 1 (*strongly disagree)*, 2 *(disagree)* and 3 *(neutral)* respectively. It could be argued that a *neutral* score, whilst not positive, is closer to being so that *disagree* or *strongly disagree,* with the former *partially out* of the set of positive factor scores, the latter *fully out*, and *disagree* responses *almost fully out.* Thus, scores of 25 or less were determined as *fully out* (allocated a value of *0*)*,* scores of 50 but less than 75 were considered *partially out* (*0.49),* and scores over 25 but less than 50 considered *almost fully out (0.25).*, This resulted raw data being converted to calibration ranges of between *0and 1*. A summary of the calibration of *conditions* appears in Table 4-1.

Calibration of the outcome sets for views of reporting was undertaken using a similar process. The data obtained for this purpose contained responses indicating whether the nurses felt the error would be formally reported or acknowledged to the client or their family. Response options were *Always, Usually, Sometimes, Rarely* and *Never.*

The ideal situation is that an error would *Always* be reported or disclosed, although the disclosure of near miss error is viewed as requiring a low level disclosure response in the event the error indicates a change in care is required (Australian Commission for Safety and Quality in Health Care, 2013a). Therefore the *crossover point* was placed between the responses of *Always* (*fully in the set)* and *Usually* (*almost in*)*.* The response of *Never* was considered *fully out* and the remaining responses of *Sometimes* and *Rarely* were also placed *outside* the set with the latter being considered closer to being *fully out.*

Table 4-1 *Calibration values for SAQ scores*

	Outside the set (factor *not positive*)				**In the set (factor *positive*)**
SAQ factor score	0-25	25.01-49.99	50-74.99	74.999	75-100
Calibration	0 minimum value *(fully out)*	0.25 *(almost fully out)*	0.49 *(partially out)*	0.5 *crossover point* *(neither in nor out)*	1 maximum value *(fully in)*

This approach to calibration of the outcome set acknowledged the different frequency of each response. For example, it could be argued that those who responded *Usually* viewed error to be more likely to be reported than those who responded *Rarely.* However, in each instance, the response was calibrated with regards to the response where *fully in* was represented by the view each error outcome would *Always* be reported or disclosed. The *qualitative descriptor* for this set was the view of the error was *Always* reported or disclosed for each of the particular error outcomes. The values assigned to each of these can be seen in Table 4-2.

Table 4-2 *Calibration values for views of reporting and disclosure of error*

	Outside the set (view error *Not Always* reported)					**In the set (view error *Always* reported)**
Response	Never	Rarely	Sometimes	Usually		Always
Calibration	0 minimum value (*fully out*)	0.15 (*almost fully out*)	0.3	0.45 (*almost fully in*)	0.5 *crossover point* *(neither in nor out)*	1.00 maximum value (*fully in*)

Conditions based upon demographic data were assigned crisp set values. That is, these conditions were allocated set membership based upon if the condition was present it was *fully in (1)* or if absent it was *fully out (0).* The crisp set approach was preferred to a fuzzy set one as it was not possible to determine the degree to which respondents were *partly in* or *partly out* of a particular demographic set. This particular form of coding allowed for comparison of the demographic condition of interest (e.g. worksite/facility location or work role) with one set of respondents compared to all others.

4.2.3 Inclusion/exclusion criteria

An outline of health care in the Tasmanian context was provided in the literature review (Section 2.3). As the research aim and research question focus on rural clinical settings, the definition of *rural clinical setting* was those located in ASGC-RA 3—5 locations which included all areas of the state except the two major metropolitan centres of Hobart and Launceston (Australian Government, 2010).

Workplace settings included acute hospitals, rural hospitals/multi-purpose services, community health centres and community nursing (including community-based programs administered by residential aged care providers), specific mental health services worksites residential aged care, disability services and general practice. These reflect those services provided in Tasmania as also noted in the literature review (Department of Health and Human Services, 2007, 2015).

Worksites excluded included those of medical specialists and dentists in private practice, other specialist services such as pathology services, worksites in education (e.g. University or vocational education providers) and volunteer- based organisations such as St John Ambulance.

A level of heterogeneity is required for CCM as it is necessary to have difference in order to make comparisons. However, this also needs to be combined with a level of homogeneity. The inclusion and exclusion criteria were therefore aimed at ensuring diversity of respondents. Details of how each element was considered may be viewed in the table in Appendix 5.

A Health and Medical Research Application was made to the *University of Tasmania Human Research Ethics Committee*. Approval was granted on 5 May 2011 (ref: H0011688). A copy of the approval appears in Appendix 1.

4.2.4 Data collection

A pilot study was conducted initially with the aim of recruiting approximately forty respondents from a sample of 125 nurses from the Health and Community Services Union (HACSU). The sample of the pilot study was based upon response rates of previous studies (Hutchinson et al., 2006; Sexton et al., 2006).

The purpose of the pilot was to test the survey and to ensure a degree of heterogeneity amongst the responses to determine that the data were suitable for a QCA analysis. Whilst limited, it was determined that there was a sufficient degree of heterogeneity amongst the sample of 11 responses that was obtained. With the low response rate in mind measures developed as part of the research design to ensure an adequate sample could be obtained. These were adopted including a direct mail-out to worksites and expanding the recruitment through other organisations.

The recruitment sample for the full study of 125 nurses was undertaken through nurse membership of both the Health and Community Services Union (HACSU) and the Tasmanian Branch of Australian Nursing and Midwifery Federation (ANMF). The aim of the recruitment process was to obtain broad heterogeneity for the QCA analysis (Berg-Schlosser et al., 2009).

The approach to participants was through an invitation distributed via email with a web-based survey link to a secure online survey. The *University Department of Rural Health* letterhead (now *Tasmanian Centre for Rural Health*) was included in the invitation. Hard copies of the invitation were also sent to worksites, followed by a reminder letter. Copies of these may be seen in Appendix 2 and Appendix 3. More detail of the process of recruiting participants is contained in an upcoming section of this chapter (Section 4.2.6).

4.2.5 Sample size

It was estimated that a study sample of between 125—150 was adequate for this research. This allowed for enough cases to conduct both PCA and *fsQCA.*

The version of the SAQ that was used contains 27 items, of which 14 relate to teamwork and 13 relate to safety climate (Hutchinson et al., 2006). Recommended ratios required for principal components analysis for responses to item range from 5:1 to 10:1 (Flin et al., 2006; Pallant, 2013; Tabachnick & Fidell, 2007). Therefore it was considered a sample of approximately 70—140 would be adequate for the SAQ data.

Although ideal for small- to intermediate-N studies, CCM is also used for large-N studies (Greckhamer et al., 2013) and the importance of sample size is less specific many statistical analyses as sample size is more dependent upon the nature of the cases and the number of conditions being considered. Subsequently the appropriate sample to obtain for CCM is difficult to determine. It is suggested for up to seven conditions a sample of 10—40 is often adequate (Berg-Schlosser et al., 2009). The representativeness of the sample obtained for this research was also considered. Where available, Australian Institute of Health and Welfare (AIHW) data were used to assist in the determining of the sample representativeness. Workforce data at the time closest to the time in which the survey was distributed were used.

4.2.6 Processes

The recruitment of participants occurred by distribution of an invitation to participate which included the link to a secure web-based survey. The invitation was sent via electronic means (email) through third parties (HACSU and ANMF) as well as through a direct mail-out of a hard copy of the invitation to worksites which potentially employed eligible participants.

The two unions were provided with a list of worksites and postcodes for the purposes of contacting their members. Emails were therefore sent directly from the third parties to their membership. The content of the emails was that approved by the ethics application process.

During both the pilot and full study the emails sent to participants from HACSU disclosed the student researcher's previous employment with that union. In addition for both studies the student researcher's employment with a major employer (current during the time of the pilot only) was declared. This ensured that participants were fully informed. So as to reduce the risk of coercion the information sent by third parties also clearly indicated that it was being forwarded.

Worksite contacts for posting information were identified for the distribution of the invitation to participate through publicly available information including the Department of Health and Human Services website , Aged Care Accreditation Standards Agency website information (now Australian Aged Care Quality Agency), the Commonwealth Services Information Database (now Commonwealth Respite and Carelink Centres Database) and the Tasmanian Division of General Practice GP database (now *Tasmanian Medicare Local*).

Survey data were collected through the *Survey Monkey* website. The function allowing participants ISP addresses to be collected was disabled ensuring participants could not be identified. The use of this website also ensured data were collected within a secure environment (SurveyMonkey, 2010).

4.2.7 Timelines

A pilot study was conducted over a period of one month in June 2011 with the survey distributed through email to 125 members of the Health and Community Services Union. As noted earlier, the primary purpose of the pilot study was to check adequate heterogeneity of responses in relation to views of reporting and disclosure as well as to test the use of the online questionnaire.

Data collection for the full study was undertaken over a six-week period from mid-March 2012 until 30 April 2012.

4.2.8 Limitations

It is recognised that there are limitations in the recruitment of the data sample (Bryman, 2012; Neuman, 2006). Despite attempts to distribute the questionnaire via employers this was not possible to achieve. Time and financial constraints impacted upon decisions regarding the recruitment process.

The invitations to participate in the online questionnaire were widely distributed. However, participants self-selected and there is always a risk in such a process that the sample obtained may not be representative (Bryman, 2012).

The online-only nature of the questionnaire may also have restricted participation. The preference for online over mailed questionnaires was made based upon the online survey not requiring data entry, thereby reducing the risk of data entry error, although error by participants cannot be ruled out.

The timing of the data collection period for both the pilot and the full study may also have impacted upon responses received. Data collection for both was conducted during a time of announcements and implementation of budget cuts by the state government. This may have impacted upon the attitudes and views of the respondents. For example, one SAQ item asks about staffing levels (Hutchinson et al., 2006) so responses to this question may have altered during a time of budget cuts.

Two approaches to data analysis were taken. How these relate to the research design is outlined in *Figure 4-1*. Variable-based analysis was conducted in the first instance. The principal components analysis from this informed the *fsQCA* whilst the inferential statistics allowed for the comparison of variables.

4.3 Variable-based data analysis

Elements of the variable-base analysis include frequency data, factor analysis (confirmatory analysis and principle components analysis), scale reliability (Cronbach α), scale scores, chi-squared and Fisher's exact test. Software used for variable-based analyses was *SPSS* (versions 20 and 21) (IBM Corp, released 2011, released 2012) and Monte Carlo (Watson, 2000) .Each of the specific analyses will now be discussed further.

Choice of chi-squared and Fisher's exact test were based upon the data being categorical in nature (Allen & Bennett, 2012; Howell, 2007). Although considered a scale, the factor scores for safety climate and teamwork were determined to be *positive* or *not positive* and therefore also categorical data. Similarly, in determining views of reporting and disclosure as *Always* and *Not Always* again resulted in categorical data.

Factor analysis is considered an important element of safety climate questionnaires (Flin et al., 2006). It was determined that responses to the SAQ items were not normally distributed (refer to Appendix 6) however it is considered that principal components analysis is robust enough to be used with such data (Pallant, 2013; Tabachnick & Fidell, 2007).

Use of Cronbach's α is recommended and this was used to check the internal consistency of the scales from factors determined by a previous study undertaken using the same questionnaire (Hutchinson et al., 2006). Due to these factor scales being determined unreliable, an exploratory principal components analysis was then undertaken. More details of this process will be presented later in this and the following chapter (Section 4.3.3 and Section 5.6)

More detail of the approach taken with regard to frequency data will now be presented including handling of missing data and assessment of sample representativeness. The process of the exploratory principal components analysis is then described, followed by details of the inferential statistical used.

4.3.1 Frequency data

The initial analysis included examination of the frequency data. Missing data were considered first, with questionnaire responses which had no data being excluded, as were those with post-codes outside the geographical area of interest. Responses with missing data relating to postcode were included in the analysis. It had been disclosed to participants that the student researcher had previously been employed by one of the unions assisting recruitment. Respondents may therefore have known the student researcher, leading to reluctance to divulge postcode information in case they could be personally identified. For example, some worksites were the sole site for health care in a particular postcode area with only one or two management staff.

It was therefore considered that whilst there was a risk that responses with no postcode information could be from outside the geographical area of interest, there was also a possibility they may not have been. It was also considered that respondents were more likely to be concerned regarding identification than they were about not providing postcode data as their worksite was outside the ASGC-RA area of interest. If a respondent who was outside the area of interest had an awareness of the ASGC-RA classification, then it would be possible for them to provide an appropriate postcode rather than not provide any information.

The decision to include these responses was incorporated with the use of sensitivity tests to determine the impact of this decision relating to statistical significance from any results. Where inferential statistics results with borderline statistical significance were obtained the tests were repeated with these responses omitted. The results tables of these tests are located in Appendix 7. A low number of responses also resulted in the combining of some categories of responses reported in the results.

Data were also missing for other items of the questionnaire. The approach to analysis determined how the missing data were treated with an emphasis on including the maximum possible respondents in any analysis. The nature of PCA determined that the missing data from the SAQ items were excluded pairwise (Pallant, 2013). For other items missing data listwise exclusion was applied.

Only those cases with complete data (that is responses to all the SAQ items and the views of reporting and disclosure) were included in the case-based analysis. This ensured that no assumptions were made regarding missing data. Although this reduced the number of cases included the calculation of a factor score from SAQ data relied on complete data so some reduction was already required.

The representativeness of the sample obtained was also considered. Where possible the frequency of demographic responses were compared to data sources such as the *Nursing and Midwifery Labour Force 2012* data (Australian Institute of Health and Welfare, 2013).

Frequency data for demographic information and views of reporting and disclosure is presented in graph format with the frequency of responses for the SAQ items presented in tables. For some analyses, responses to demographic categories were combined (Howell, 2007; Pallant, 2013) as this enhanced the analysis as well as reduced the possibility of respondents being identified.

Frequency data were also produced regarding positive scores for the factors of teamwork and safety climate. However, these could not be calculated until the number of factors and items were identified through analysis of the SAQ including principal components analysis. This will now be outlined.

4.3.2 Analysis of conditions data

As mentioned earlier in this chapter (Section 4.2.1) the first section of the survey contained the SAQ items. A recent review has outlined several ways in which a questionnaire such as the SAQ may be assessed in relation to reliability and validity. *Reliability* is defined as the consistency to which a data collection instrument measures something across a variety of conditions whereas *validity* refers to whether or not the questionnaire measures what it is supposed to measure (Valentine et al., 2015).

The review highlights four areas that address these elements. These areas are *internal consistency, interrater agreement and reliability, structural validity* and *content validity*.

The previous use of the SAQ in the UK addressed three of these four areas with only interrater agreement and reliability not reported by the study (Valentine et al., 2015). The work of Sexton and colleagues is noted to have addressed these same three areas (Valentine et al., 2015).

Interrater agreement was not assessed in this research. This process is often not reported for this type of questionnaire as many of the analyses rely upon a test-retest approach which was not part of the research design for this study (Valentine et al., 2015). In addition, neither of the questionnaires informing this research had reported interrater agreemen.t leaving no capacity to benchmark this (Hutchinson et al., 2006; Sexton et al., 2006; Valentine et al., 2015).

Internal consistency refers to the degree to which items in a scale correlate and is therefore a form of determining *reliability* (Valentine et al., 2015). Use of Cronbach's α is one approach to assessing internal consistency. For this research the internal consistency of the SAQ items was checked with the use of Crohnbach's α (Pallant, 2013) (Valentine et al., 2015). A value of 0.70 from this test is considered to indicate reliability (Matsunaga, 2010).

Structural validity considers the degree to which scale items have a high covariance in structure and may be assessed through both confirmatory and exploratory factor analysis (Valentine et al., 2015). The previous UK study had conducted both exploratory and confirmatory analyses (Hutchinson et al., 2006). It is recommended that a different data set be used for confirmatory analysis (Matsunaga, 2010) and these authors met this through randomly dividing their sample in two and conducting each analysis on a separate data set.

Assessment of structural validity of this research was limited. The assessment using Cronbach's α indicated scale data were not reliable when applied to the scale determined from the UK study (Hutchinson et al., 2006). Therefore an exploratory principal components analysis was necessary.

It is recommended that confirmatory analysis be undertaken following this process using a separate set of data (Matsunaga, 2010). This was not possible as the entire data set was used for the exploratory analysis. Although this is a limitation of this research of the four elements highlighted earlier (Valentine et al., 2015) as many as possible have been undertaken from the data that were obtained.

4.3.3 Principal components analysis

Principal components analysis (PCA) (often also referred to as factor analysis) is a statistical technique used to determine a set of independent subsets from within a set of variables (Tabachnick & Fidell, 2007). This process is used in developing scales and may be used in an exploratory or confirmatory capacity (Pallant, 2013). Here it has been used in an exploratory capacity.

The key element of PCA is its use for item-screening (Matsunaga, 2010). In this thesis PCA has been used for the analysis of the first section of the survey which used the safety attitudes questionnaire (SAQ) (Sexton et al., 2006). This approach was also chosen due to its previous use by other applications of the same survey tool (Hutchinson et al., 2006).

Several steps are outlined for the process of PCA (Pallant, 2013). Data must be considered suitable, the number of factors to extract needs to be determined and finally the rotation of data and interpretation is finalised. Steps to encompass this include determining the suitability of data and sample size, factor extraction and rotation of factors. These are outlined in the following sections and were followed in order to determine the number of factors to be extracted. It is generally regarded that a single factor is made up of at least four items (Matsunaga, 2010).

There needs to be sufficient data for this analysis (Pallant, 2013). It has been previously been noted that sample size needs to be as large as possible so as to minimise the risk of incorrect results through bias or misspecification (Matsunaga, 2010). Opinions of the sufficiency of data vary from 5:1 to 10:1 ratios of responses to items (Pallant, 2013) with one author citing a minimum of 100 respondents (Matsunaga, 2010).

When considering the sample size (Section 4.2.5) it was determined that between 125—150 responses would be adequate. This assessment also took into consideration that from a previous use of the SAQ analysis had been undertaken in two separate analyses, one for teamwork items and another for safety climate items (Hutchinson et al., 2006).

4.3.4 Factor extraction

The extraction of factors involves a variety of different steps (Pallant, 2013). These include the use of Bartlett’s Test of Sphericity, Kaiser-Meyer-Olkin (KMO) and Eigenvalues, Kaiser’s criterion, scree test and parallel analysis. Some of these are considered controversial and capable of producing variety in the results (Hubbard & Allen, 1987).

Both Bartlett's Test of Sphericity and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (Pallant, 2013; Tabachnick & Fidell, 2007) were used to determine the suitability of the data for further analysis. A KMO value of 0.6 is recommended along with significance of Bartlett's Test of $p<0.05$ (Pallant, 2013; Tabachnick & Fidell, 2007).

Some of the SAQ results obtained for this research impacted upon this process. Further details of how this was dealt with appear in the following chapter (Sections 4.3.1 and 4.3.3).

Analysis then proceeded to consider Kaiser's criterion and Catell's scree test (Pallant, 2013; Tabachnick & Fidell, 2007). These processes assist in determining the appropriate number of factors to extract in each of the two sample sets (Tabachnick & Fidell, 2007).

Kaiser's criterion recommends an eigenvalue score of ≥ 1.0 (Matsunaga, 2010; Pallant, 2013; Tabachnick & Fidell, 2007). Caution is urged however as it has been established that this process often leads to over extraction of factors (Hutchinson et al., 2006; Matsunaga, 2010). Catell's scree test may also be inconclusive in similar circumstances as often it is difficult to determine the number of possible factors to extract (Pallant, 2013).

An alternative to the two aforementioned tests is parallel analysis and this approach was adopted to assist addressing the above mentioned concerns. This complex approach is becoming more popular in social science literature (Pallant, 2013) and is considered often to be the most accurate means of extraction (Hubbard & Allen, 1987; Matsunaga, 2010). Parallel analysis was applied along with use of Horn's test (Hubbard & Allen, 1987; Zwick & Velicer, 1986) and the freely available Monte Carlo software (Watson, 2000).

4.3.5 Rotation of factors

The final element of PCA that needs to be discussed is the use of rotation. The two main approaches are oblique and orthogonal (Child, 2006; Matsunaga, 2010; Pallant, 2013). The main difference between the two is that orthogonal rotation assumes there is no underlying relationship or correlations in the data (Tabachnick & Fidell, 2007). It is therefore considered by many that oblique rotation methods are more appropriate as most data collection is likely to be correlated (Tabachnick & Fidell, 2007) especially in the social sciences (Child, 2006; Matsunaga, 2010).

Component and pattern matrix tables are elements that also need to be considered when undertaking PCA (Pallant, 2013; Tabachnick & Fidell, 2007). The component matrix reflects the unrotated loadings of the Kaiser criterion whereas the pattern matrix presents the rotated solution (Pallant, 2013). There is debate in the literature about which of these should be interpreted (Matsunaga, 2010).

Following factor extraction the unrotated solution is often difficult to interpret and the goal of rotation is therefore to improve this (Tabachnick & Fidell, 2007). Numerous approaches to rotation are available but unfortunately there is no consistent approach with recognition that different approaches may be taken by different researchers (Tabachnick & Fidell, 2007).

Oblique rotation using Direct Oblimen (Pallant, 2013; Tabachnick & Fidell, 2007) was found to be the approach that yielded factors that could be interpreted with a simple structure. This particular rotation method is useful as it allows for a wide range of factor correlations (Tabachnick & Fidell, 2007).

The experience of use of the SAQ in the UK study was also drawn upon in determining which items to retain (Hutchinson et al., 2006). It is worth noting here that in a previous study the PCA for the teamwork factors was difficult and this also occurred with this present research (Hutchinson et al., 2006)

Following completion of the above steps the extracted factors were finalised. Having determined the items to retain, the internal consistency was assessed through the use of Cronbach's α (Pallant, 2013). A score of 0.7 or higher is considered to reflect reliability (Allen & Bennett, 2012; Pallant, 2013). Following determination of the reliability of the identified scales, scores for each respondent were calculated. The formula used for this purpose was outlined previously when set calibration was discussed in Section 4.2.2.

This approach to handling of the data for the conditions of this research allowed for transparency in terms of the manner in which the conditions were determined. It also provides an approach consistent with other studies that provided for a comparison of the results obtained from this research with those of other studies.

4.4 Inferential statistics

As previously mentioned the data obtained for this research were categorical and thus inferential statistics were used to determine the probability and significance of differences in the data (Allen & Bennett, 2012; Howell, 2007; Pallant, 2013). The use of inferential statistics has also previously been undertaken with use of the SAQ (Colla et al., 2005). Due to the low response rate in this research there were some responses with similar low frequency. The result was the violation of assumptions for this test in that many cells in the analysis had a count of less than five responses (Pallant, 2013).

With this in mind the Fishers Exact Test was also used (Howell, 2007). In some cases this could not be calculated due to the increased number of variables increasing the complexity of the calculation (Howell, 2007). However in most elements the test was able to be applied.

Whilst it has been argued that this analysis should only be used for a 2x2 design, others have considered the approach adequate for larger designs (Howell, 2007). Therefore the results of this research need to be considered with the knowledge that the best available test was used for the data that were obtained, bearing in mind that the analysis is subject to limitations.

In order to produce a 2x2 or table with fewer categories for comparison it was necessary to combine the categories of responses (Howell, 2007; Pallant, 2013). There were some areas where it was not possible to combine categories as to do so did not make sense. For example, a response of *Unsure* could not always be allocated to another category. Where numbers of responses were extremely low and there was no logical means of allocation to another category, these responses were excluded from the analysis. Where such an exclusion was applied it has been clearly noted.

The use of a 2x2 design requires adjustment to the Chi-squared (χ^2) value. The Yates Continuity Correction is therefore the value reported in the Chi-squared tables of a 2x2 design (Howell, 2007; Pallant, 2013).

These approaches adopted as part of the analysis with inferential statistical, whilst being required in order to produce results, also subject these same results to potential biases. It is therefore interpretation of these results needs to be mindful of this.

4.5 Case-based data analysis

The preparation of the data for case-based analysis was discussed earlier (Section 4.2.2). There is one further step required before the analysis proper and that is the use of Boolean algebra. This is required in order to use the software for analysis as well as to be able to interpret the results from *fsQCA*.

The allocation of Boolean algebra expressions was made relating to safety climate factors and views of reporting and disclosure. The teamwork factors from the SAQ were allocated the expression *tf* and the safety climate factors allocated the expression *scf.* Numerical assignment also occurred in terms of the factors. For example, the first teamwork factor identified was allocated the expression *tf1* and further factors allocated *tf2* and so on.

Boolean terminology used for this research reflects that which uses common features of the QWERTY keyboard (Schneider & Wagemann, 2012). The rationale for this choice is that it reflects the terminology of the software used for analysis.

Views that an error would always be reported were allocated the expression *sr* (severe error *Always* reported), *mr* (moderate error *Always* reported) and *nmr* (near miss error *Always* reported). Views of disclosure were allocated the expressions *sd* (severe error *Always* acknowledged), *md* (moderate error *Always* acknowledged), *nmd* (near miss error *Always* acknowledged). The non-presence of any condition or outcome (referred to as negated) is represented by the use of the symbol ~ prior to the Boolean term. Full details of the final expressions used, including the appropriate Boolean operators, are provided in the following chapter (Section 5.11.2).

Table 4-3 Software used for *fsQCA analysis*

Action	Software
Set calibration	*fs/QCA* used to calibrate condition sets
Test for necessary conditions	*fs/QCA*
Construction of truth table	*fs/QCA*
Test for sufficiency	*fs/QCA* (standard analysis) *Kirq* (for identifying cases consistent and contradictory to solution terms for truth tables and results tables)

Two different software packages were used for the *fsQCA.* The use of each is outlined in Table 4-3. The *fs/QCA software* (Ragin & Davey, 2012) was used for set calibration of condition sets and the analysis of necessary and sufficient conditions. The identification of contradictory cases in the truth tables and the final solutions for sufficiency was obtained through use of *Kirq* (Reichert & Rubinson, 2014).

4.6 During the analytic moment

With the preparation of data completed the next phase of the *funnel of complexity* is entered. The *during the analytic moment* phase is where the analysis proper occurs (Rihoux & Lobe, 2009; Schneider & Wagemann, 2010). This includes the analysis of whether or not *conditions* are *necessary* or *sufficient* for *outcome(s)* (Berg-Schlosser et al., 2009; Schneider & Wagemann, 2012).

A *condition* is described as *necessary* for an outcome if it is always present when the outcome occurs (Berg-Schlosser et al., 2009; Schneider & Wagemann, 2012). In other words, the outcome cannot occur if the condition is absent (Berg-Schlosser et al., 2009). The outcome is therefore a subset of the condition (Schneider & Wagemann, 2012).

For a condition to be described as *sufficient* it is present when the *outcome* is also present but there may be examples of cases that display the *outcome* when the *condition* is not present (Berg-Schlosser et al., 2009; Schneider & Wagemann, 2012). That is, there may be other causes for the outcome and the causally sufficient condition is a subset of the outcome (Schneider & Wagemann, 2012). Both *necessary* and *sufficient* conditions may be present when using *fsQCA*.

An example of necessity and sufficiency, attributed to Lasse Conqvist, is given through three possible conditions relating to democratic states (Berg-Schlosser et al., 2009). These are condition A (holding regular competitive elections), condition B (ensuring civil liberties are comprehensive) and condition C (ensuring political decision makers are independent of the military. If two paths to the outcome were determined to be a combination of condition A and condition B (path 1) and condition A and condition C (path 2) then each of these to paths is sufficent. Condition A is not alone sufficient for the outcome as another condition is required. Each of the paths, however, can be considered as sufficient. As condition A is always present when the outcome occurs then it is considered a necessary condition.

4.7 Test for necessity

Performing a test for necessity is the first step of analysis with *fsQCA.* Such tests assess the degree to which a condition is present for an outcome. As the definition of *necessity* requires that the condition is always present when the outcome occurs then a threshold needs to be set that reflects this. This is referred to as *consistency* (Ragin, 2009; Schneider & Wagemann, 2012). It is considered that for a *test of necessity* such a threshold should be set at no less than 0.9 (Ragin, 2009). That is, when the condition is present the outcome is present in the majority of cases. A necessity threshold of 1.0 indicates the condition is present in all cases.

It is important that this test is undertaken first so that if a condition is assessed as *necessary* then this information can be incorporated when undertaking fsQCA. In addition, there are times when the nature of the data leads to necessary conditions being present in solution terms when they are not truly necessary *(false necessary condition)* or the solution terms indicate that there is no necessary condition when there is *(hidden necessary condition).* For those interested in the complex set theoretical mathematics behind the occurrence of this anomaly then further information is available in the text-book authored by Schneider and Wagemann (2012).

The *consistency* for *necessity* for this research was set at a threshold of 1.0. A test of necessity was undertaken for each teamwork and safety climate factor identified from PCA as conditions for each of the outcomes of interest for views of reporting or disclosure and the severity of error (*sr, mr, nmr, sd, md* and *nmd*).

Cases were also calibrated into sets for each work location/setting and work role and further tests for necessity were undertaken in these groups. All outputs for necessity tests from *fs/QCA software* (Ragin & Davey, 2012) appear in Appendix 16.

4.8 Test for sufficiency

Once data have been calibrated and the *test for necessity* performed it is possible to then undertake the next step of the analysis, the *test for sufficiency*. This process, undertaken with the use of software produces a *truth table.* This table contains all the configurations possible for a particular set of conditions. That is, the dichotomous table of the possible configurations is produced (Berg-Schlosser et al., 2009; Ragin, 2009; Rihoux & Lobe, 2009; Schneider & Wagemann, 2012). For any analysis the total number of conditions is 2^k where k is the number of conditions (Ragin, 2008). Therefore, an analysis with three conditions has eight possible combinations ($2^3=8$).

The truth table also contains other information that was used in this research. The number of cases present for each configuration is provided, giving an indication of the diversity of the configurations of conditions present amongst the cases.

Use of *Kirq* software (Reichert & Rubinson, 2014) identifies those cases that are present for the outcome and those which contradict it. A value of consistency is provided for each configuration present in both *Kirq* and *fs/QCA* software with the latter platform also providing values for *proportional reduction in consistency* (PRI) and *PRODUCT* (Ragin, 2006; Schneider & Wagemann, 2012). How each of these has been used in this research will now be outlined in more detail.

4.8.1 Contradictions

Where cases exhibit identical causal conditions but where the outcome is different they are referred to as *contradictions* (Berg-Schlosser et al., 2009; Ragin, 2009). These configurations must be acknowledged and preferably resolved by the researcher.

The nature of the fuzzy social set data is that contradictory cases will appear. Examination of these requires the researcher to explore cases further in an effort to resolve them, making reference to the theoretical perspectives upon which the research has been developed (Rihoux & de Meur, 2009).

Several options are available for this purpose. This includes adding a condition (or removing one), re-examining the operational aspects of the conditions, reconsidering the outcome variable, re-examining the cases for additional information that may differentiate them, re-examining cases to determine if they really are part of the same population, recode contradictory rows as '0' and/or use frequency criteria to establish the outcome (Rihoux & De Meur, 2009).

For this research a proportional threshold of 0.85 (85%) was set regarding the inclusion of contradictory cases. In doing so it is possible to state that of the results for any *Analysis Z* conducted for this research at least 85% of the cases in the configuration were consistent for the outcome. Such a statement forms part of the description of the complexity of the cases. This contributes to meeting the aim of this research which is to *describe the complexity of safety climate of nurses working in rural clinical settings.*

This can be undertaken using the *Kirq* software (Rubinson, 2013). Where this has occurred it has been noted in the results. This value was based upon the results of the frequency data obtained in relation to views of error reporting and disclosure (Section 5.4) and ensured that the minimum number of consistent cases was no less than the frequency percentage of views that a severe error would *Always* be reported.

Cases were also re-examined to see if specific demographic conditions were present that differentiated them. This resulted in the additional conditions being added for further analysis. More detail regarding this appears in the following chapter (Section 5.14.

Responses to this research were anonymous resulting in case knowledge being limited to the data obtained from the survey. Therefore whilst contradictory configurations were acknowledged and where possible further exploration of cases occurred through consideration of demographic data, any further revisiting of cases was not possible. This limitation is the outcome of the necessary step of addressing the ethical issues ensuring potential identification of participants did not occur (Sections 4.2.1 and 4.3.1).

What is important to note from this discussion of cases with contradictory configurations is that they must first and foremost be acknowledged (Schneider & Wagemann, 2012). In addition, they are potential examples of cases that are unusual. It is this unusual nature that makes them ideal for exploring possible new theories in relation to the conditions and outcome of interest.

It is not always possible to resolve all contradictory rows within a truth table. Therefore the *sufficiency consistency* value provided in the *truth table* is used as a guide as to which rows to include in the analysis.

In using the truth table for analysis the researcher must determine the level of consistency which is required for undertaking further analysis. This is the threshold which configurations must achieve in order to be included in the analysis (that is to be included in the subset of cases that display the outcome). This point is referred to as the *sufficiency cut-off* or *sufficiency threshold* (Ragin, 2009; Schneider & Wagemann, 2012). Detail regarding how this was determined will now be provided.

4.8.2 PRI and PRODUCT

Two other values have been used to assist determination of the inclusion of configurations within the analysis with *fsQCA.* These are the PRI and PRODUCT (Ragin, 2006). The *proportional reduction in consistency* (PRI) provides the consistency value of how much a condition is the subset of not only the outcome, but the non-outcome (absence of the outcome) as well (Ragin, 2006; Schneider & Wagemann, 2012). That is, it is possible that a case is a member of both. The

PRODUCT is the multiplication of the values for consistency and PRI (Ragin, 2006; Schneider & Wagemann, 2012).

It is recommended that these values be considered. If consistency and PRI are high then the PRODUCT will also be high. If the PRODUCT value is high then it is clear that set membership in the outcome or non-outcome set is non simultaneous Schneider & Wagemann, 2012). (The PRODUCT minimum for this research was therefore set at a minimum of 0.75 which is slightly lower than the minimum 0.80 consistency cut-off and slightly higher than the recommended minimum consistency cut-off value of 0.70

A *truth table* was produced for all the outcome and negated (non-outcome) sets for this research. However, where consistency, PRI and PRODUCT values were outside those that set for inclusion in this research analysis with fsQCA did not proceed further. . These truth tables appear in Appendix 1.

4.8.3 Multiple outcomes analysis

It is possible to undertake a multi-level analysis using configurational comparative methods. For this the cases are grouped within similarity of context, cases within each group are compared and comparison made between the context based upon the differences or similarities in the causal relationship that are found between the contexts (Byrne, 2011).

This research however considers a multi-level analysis of different outcomes. That is, the conditions (factors scores for teamwork and safety climate factors) were compared for each of the six different outcomes (the views of reporting and disclosure for different levels of harm). In doing so it was possible consider the consistent data obtained for the conditions against the various levels of harm for both reporting and disclosure views.

The only difference between each of these outcomes was that they related to either reporting or disclosure or different levels of severity of harm. There were six possible outcomes. Thus the outcomes were similar and could therefore be compared based upon the differences alone (Byrne, 2011).

A series of consistent parameters were needed to ensure the results from analyses for the different outcomes could be compared. These parameters appear in Table 4-4. The first possible analysis (*Analysis X*) ensured that only fully consistent rows of configurations with a consistency of *1* were included in the analysis. The second analysis *(Analysis Y)* also ensured only configurations consistent for the outcome of interest were included but the consistency needed to be ≥0.85. For the final analysis *(Analysis Z)* the consistency cut-off applied was also ≥0.85 but with a proportion threshold of ≥0.85 applied to ensure no less than 85% of the cases included for any inconsistent row were consistent for the outcome.

The minimum threshold recommended is no less than 0.75 (Ragin, 2009). For this research the minimum threshold was therefore set higher at 0.80.

Table 4-4 *Analyses parameters*

Analysis name	Consistency cut-off	Consistency proportion threshold	Inclusion of inconsistent cases
Analysis X	1	1	No
Analysis Y	≥0.85 but ≤1	1	No
Analysis Z	≥0.80 but ≤1	≥ 0.85	Yes

Where possible, analysis with consistency cut-off and proportion thresholds of 1 were preferred. This assisted in ensuring comparison could be made between different outcomes therefore contributed towards achieving the aim of the research.

There are examples of studies of larger numbers (large- or intermediate-*N)* where the frequency threshold (that is the number of cases present in a given configurational row of the truth table) is set higher (Greckhamer et al., 2013). However, as the aim of this research is to *describe the complexity of safety climate of nurses working in rural clinical settings* the frequency threshold was kept at 1.

4.8.4 Logical remainders

As previously noted, QCA considers conditions in combination in relation to an outcome set. Each row of a truth table includes one of the possible configurations.

The number of conditions allows for the determination of the number of possible configurations of conditions to be determined through the use of the formula 2^k where k = the number of conditions. Thus analysis of three conditions means there would be 2^3 or eight possible configurations.

However, during any analysis not all configurations may be present in a given data set. Indeed some may even be implausible or incoherent. When a configuration is not present amongst cases included in an analysis it is referred to as a *logical remainder* (Berg-Schlosser et al., 2009; Schneider & Wagemann, 2012).

Logical remainders are considered as part of *fsQCA*. Where any decisions are made about a logical remainder the researcher may use theory in making an assumption about the outcome and/or consider the outcome of other configurations (Fowler et al., 2008; Ragin, 2009). In this sense the researcher is making assumptions about the directions of the factors within the configuration itself. No assumptions were made in this research regarding logical remainders as it was not possible to determine any assumptions based upon the data obtained or from available research.

The outputs from *fs/QCA software* produce three solution terms. These are the *complex, parsimonious* and *intermediate* solutions (Ragin, 2009; Schneider & Wagemann, 2012). Each reflects a different assessment of the underlying subset relations.

The *complex* solution does not make any assumptions regarding logical remainders (Ragin, 2009; Schneider & Wagemann, 2012). The *parsimonious* solution makes simplifying assumptions to ensure the solution presented contains the least number of *Boolean* operators (Ragin, 2009; Schneider & Wagemann, 2012). More detail regarding this is provided in the following chapter with reference to a result from this research (Section 5.13.2).

The *intermediate* solution term refers to the solution produces when directional assumptions are made or where specific decisions are made regarding contradictions (Ragin, 2009; Schneider & Wagemann, 2012). It is generally considered that this solution term is the one that should be reported.

The *complex* solution term covers all the possible subset relations from the various *intermediate* solution terms (Ragin, 2009; Schneider & Wagemann, 2012). This solution term is a subset of the possible solution terms (Schneider & Wagemann, 2012). However, in the event there are no directional assumptions made regarding logical remainders (as is the case with this research) the *intermediate* solution is the same as the *complex* solution. For this research it is the *intermediate* solution term that is presented in respect to *fsQCA* results.

4.8.5 Negated sets (non-outcome)

As noted in the previous chapter, CCM are asymmetrical (Byrne, 2011; Ragin, 2009; Rihoux & Lobe, 2009; Schneider & Wagemann, 2012). That is, the presence of a condition does not automatically mean the non-presence is causal for the non-outcome. For this reason analysis of the negated outcome set should also be considered. The non-membership of a condition or outcome is referred to as the *negated set* (Ragin, 2009; Schneider & Wagemann, 2012).

A *truth table* was produced for all the outcome and negated (non-outcome) sets for this research. However, as noted in Section 4.8.2, not all truth tables proceeded to analysis with fsQCA. . These truth tables appear in Appendix 1.

4.9 After the analytic moment

Once the *fsQCA* analysis has been completed the results need to be presented and also interpreted with regard to theoretical and case knowledge. This occurs in the *after the analytic moment* phase (Rihoux & Lobe, 2009; Schneider & Wagemann, 2010).

An overview of the solution terms that result from the analysis and how these will be presented is provided here. More details will be provided in the following chapter.

To enhance transparency it is highly recommended that the raw data and calibrated data used for *fsQCA* is provided (Rihoux et al., 2009; Schneider & Wagemann, 2010). This information is provided in Appendix 13and Appendix 15.

Publication of all raw data obtained from the survey has not been undertaken as it may be possible to identify a respondent and/or their workplace and mechanisms to reduce such a risk were included in the ethics application (Sections 4.2.1 and 4.3.1). However, raw the raw data table does contain each of the factor scores (teamwork and safety climate) as well as the responses relating to views of reporting and disclosure.

Calibrated data have also been provided. This data table includes the allocation of crisp set membership to the demographic data relating to workplace setting and work role.

It is also recommended that results are presented through at least two means (Schneider & Wagemann, 2010). Use of software produces solution terms which summarise the configurations present for the outcome of interest. These results will be presented in two formats.

Firstly a table containing the solution terms with the cases contained in each is provided. This table notes the cases that are consistent and those not consistent with the proposed solution term. These solution term tables contain the numerical detail at the level of the software output. In some instances, the data in this table will be rounded when reporting the results in text. Reporting all software output values in full would provide a level of detail not required. However, consistency scores of greater than *0.995* will be reported in full as rounding would produce a value of *1.00,* giving a false indication of full consistency.

The second presentation of results is in the form of a matrix containing the comparison of the multi-level outcome analysis. More detail of this is provided in the following chapter at the point where the results are presented.

Tables containing the solution terms report the consistency, raw coverage, unique coverage, solution consistency and solution coverage. A summary of the definitions of each of these appears in Table 4-5.

Table 4-5 *How to interpret QCA results terms in this thesis*

Outcome	**Logical Equations**
Consistency	Expression of percentage of cases' set membership scores in two sets that is in line with the statement that one of the sets is a subset of the other (Schneider & Wagemann, 2012)
Raw coverage	Percentage of cases' set membership in outcome covered by a single sufficient path of the equifinal solution term (Schneider & Wagemann, 2012)
Unique coverage	Percentage of all cases' set membership in the outcome that is uniquely covered by a single path of an equifinal solution term (Schneider & Wagemann, 2012)
Solution consistency	Expression of consistency of the complete solution term
Solution coverage	Percentage of all cases' set membership in the outcome covered by the solution term (Schneider & Wagemann, 2012)

These terms are referred to as *parameters of fit* (Schneider & Wagemann, 2012). Two key parameters are those of *consistency* and *coverage. Consistency* has already been noted in previous sections of this chapter (Sections 4.7and 4.8).

The *solution consistency* refers to the *consistency* value of the complete solution term (Schneider & Wagemann, 2012). The *solution coverage* is a value indicating the percentage of all cases that have membership in the outcome to which the solution term refers (Schneider & Wagemann, 2012).

Low *solution coverage* may indicate that a solution term is trivial. That is, although a solution term may have a high consistency if the solution coverage is low then the solution has less relevance to the cases (Ragin, 2006).

Raw coverage is also used when interpreting the results. This term refers to the coverage of a single equation within the overall solution term. That is, the term is used in reference to how much membership of the outcome is covered by a single path in a solution term (Schneider & Wagemann, 2012). Once again, if *raw coverage* is low then that particular equation within the overall solution may also be of less relevance.

This compares *unique coverage* which refers to the coverage of a single path in a solution term that does not overlap with another condition (Schneider & Wagemann, 2012). That is, it makes reference to how much a single path is uniquely covered. What is important with coverage, as with any element of *fsQCA,* is that the interpretation of the results needs to occur in conjunction with the overall research design and theory upon which the research is based.

4.10 Chapter summary

This research has clearly been based upon theoretical knowledge of safety climate, error reporting and error disclosure. The aim of the research, the research question and several sub-questions were developed from a review of the literature. These have subsequently informed the research design. Standards of good practice for the use of a CCM have also been applied to all phases of the *funnel of complexity.*

This has ensured that *before the analytic moment* the selection of cases, conditions and outcomes was based upon theory. Similarly set calibration was based upon the research questions developed in previous chapters, and was therefore theoretically derived.

Data were collected and analysed according to the process methods outlined in this chapter. This included ensuring the sample size was appropriate in order to perform the desired analysis of both variable and case-based approaches.

A specific approach to the analysis with *fsQCA* has been provided to ensure that a multiple outcome comparison is possible. Appropriate parameters have been set for this.

Having obtained the responses it was possible to conduct the analysis as outlined in this chapter. The results will now be presented in the Chapter 5.

5 Results

Health care professionals work within a complex system, in complex work environments, dealing with complex issues. Management of medication error is but one of the many patient safety issues managed by nurses within rural clinical settings.

The aim of the research is to *describe the complexity of safety climate of nurses working in rural clinical settings.* This has been undertaken through the principal research question of *how is safety climate related to views of reporting and disclosure of medication error amongst nurses working in rural clinical settings?*

The research aim assumes complexity. In order to address the research aim and research question it was necessary to consider the nature of the safety climate in which rural nurses work, the level of error that they think is being reported and disclosed and the relationship between each of these.

Acknowledging health care as a complex system required a method that allowed complexity to be researched. Configurational comparative methods acknowledge complexity and therefore the research design reflected this approach. Use of the *funnel of complexity* informed this design ensuring the appropriate processes for collecting and preparing data, along with analysis and interpretation of that data, would be followed.

It was important that the research design was informed by theoretical knowledge. Three research sub-questions were therefore developed from examination of the literature relating to safety climate, error reporting and disclosure. A further two sub-questions were developed through consideration of knowledge generation within a complex health system.

These five research sub-questions are:

1. *What is the nature of workplace safety climate amongst nurses in rural clinical settings?*
2. *What level of reporting and disclosure of different severity of a hypothetical medication error do nurses in such settings think is occurring?*
3. *What is the relationship between workplace safety climate amongst nurses in rural clinical settings and their views of reporting/disclosure of a hypothetical medication error?*
4. *How is the understanding of the relationship between workplace safety climate and views of reporting medication error changed through the use of a configurational comparative method?*
5. *What does this mean for the management of medication error?*

As outlined in the literature review, the complexity of safety culture commences with the definition of the term *culture.* Safety climate has been determined as a measureable element within safety culture. Thus, this research considers safety attitude, an element of safety culture, which itself is an element of the broader workplace culture.

Medication error is a key area of error. It is estimated that it costs the Australian health system AU$1.2 billion annually (Australian Commission for Safety and Quality in Health Care, 2013b). Nurses have a key role in the administration of medications (Choo et al., 2010).

As highlighted in the literature review, public enquiries and research usually focus on what has gone wrong. Debate suggests that this has resulted in the measurement of the lack of safety rather than understanding what is needed for things to go well (Hollnagel, 2014).

Error disclosure is now a national standard for accreditation of hospitals in Australia (Australian Commission for Safety and Quality in Health Care, 2011a). As outlined in the literature review there are many elements as to why full, open disclosure is important. Not only is it something consumers consider important, clinicians also suffer when an error occurs and full disclosure does not occur (Hall & Scott, 2012; Nelson & Beyea, 2009; Wu & Steckelberg, 2012).

This research is located in Tasmania, the island state within Australia. The research subjects have been restricted to nurses. For the purposes of this research the worksites in ASGC-RA 3—5 localities (Australian Government, 2010) were considered *rural.*

The methodological approach undertaken in determining the relationship between safety climate and views of reporting and disclosure of error has focused upon accepting the complexity of the health care system (Martin & Félix-Bortolotti, 2010). Complexity science has provided the framework for the research and this has been described in detail in Sections 3.3 to 3.5 of a previous chapter.

Configurational comparative methods may be used in several ways. For this research *fsQCA* has been used to both summarise the data obtained through undertaking a case-based analysis and to use this analysis for theory development (Berg-Schlosser et al., 2009). As recommended by Schneider and Wagemann (2010) an additional method has been used in the form of inferential statistics for analysis of the questionnaire data.

Data were obtained through use of a questionnaire comprising three sections: the Safety Attitudes Questionnaire (SAQ) (Hutchinson et al., 2006; Sexton et al., 2006); an error scenario with three levels of harm asking respondents to indicate the likelihood it would either be formally reported or acknowledged to the patient/client or their family (Weissman et al., 2005); and demographic information.

Invitations to participate in the research through completing an online questionnaire were distributed to Registered and Enrolled Nurses of eligible worksites through two approaches. The first was a direct mail-out of an invitation to participate in the online survey to eligible worksites and the second was through an email via the two nursing unions to nurses working in those same worksites.

5.1 Chapter outline

The results for this research are presented in two parts. The first will present the variable-based results relating to frequency data, principal components analysis and inferential statistics and the second the case-based results from *fsQCA*.

The variable-based results include the data relating to demographic information obtained as well as the frequency of views of reporting and disclosure and the frequency data obtained from the SAQ. These data therefore considers the nature of the sample obtained as well as addressing the first two research sub-questions relating to the nature of safety climate and the level of reporting that nurses think is occurring.

This will be followed by presentation of the Principal Components Analysis (PCA). This was undertaken in order to transparently determine factors of teamwork and safety climate, the condition of interest in this research. These results relate to the second research sub-question regarding the nature of safety climate amongst nurses working in rural clinical settings.

The final element of *Part I* is presentation of results from the analysis using inferential statistics. Views of reporting and disclosure are noted to be different amongst nurses based upon some of the demographic information obtained. Differences between demographic data and some of the teamwork and safety climate factors from this analysis have also been identified. Results also suggest that differences exist between some factors of teamwork and safety climate and views of reporting and disclosure.

These results inform the first three research sub-questions relating to the level of reporting and disclosure nurses think is occurring, the nature of safety climate in which rural nurses work and the relationship between these two. The latter of these research sub-questions is also informed through the results presented in *Part II.*

This second section of the chapter presents the results from *fsQCA*. Two levels of analysis were undertaken to produce these results. Firstly, an analysis of the factors of teamwork and safety climate (conditions) and the views of reporting and disclosure (outcome) was undertaken (Section 5.13). Following this, further analysis was done using demographic information. The process for this second analysis was informed by the results of the inferential statistics. More detail with regard to this will be provided in Section 5.14.

Part I: Variable-based results

Results of the variable-based analysis of the data are included in this first section. Several forms of analyses were used for this purpose.

The questionnaire responses, including how missing data were handled and the assessment of sample representativeness, are the first areas considered in these results. The frequency data are then presented for the demographic data views of reporting and disclosure and each item of the SAQ.

The low response rate in relation to some of the demographic and frequency information had implications for further analysis. Where relevant, the detail relating to how this was handled is undertaken in relation to where the relevant frequency data have been presented.

Further results relating to the SAQ are then presented. Included is an examination of the internal consistency of the scale from the previous UK study using data obtained for this present research. Having determined the scale not to be reliable, results from a subsequent exploratory principal components analysis are presented.

These results are then utilised to calculate factor scores for each respondent. Once this is achieved, the frequency of responses with positive factor scores is presented.

With data relating to factors of teamwork and safety climate as well as views of reporting and disclosure of error determined, results from the inferential statistics analysis are presented. Differences found when comparing views of reporting and disclosure with demographic data are presented first. These results are followed by the differences found when factors of teamwork and safety climate were compared with the same demographic data.

Then, results relating to the differences found when comparing factors of teamwork and safety climate with views of reporting and disclosure of error are presented. *Part I* concludes with a summary of the variable-based results.

5.2 Questionnaire responses, missing data and sample representativeness

A total of 123 responses were received from the invitation to participate in the online questionnaire for this research. Of these five responses did not include any data so were excluded. Two responses indicating postcodes outside the ASGC-RA 3—5 areas of interest were also excluded. It is possible these responses were received from nurses who received the invitation through their union as a result of inaccurate membership data.

A further five responses did not include any postcode data. Three of these contained incomplete questionnaires, leaving two fully completed questionnaires. Whilst it is possible these responses were from nurses in workplaces outside the geographical area of interest, it was also considered possible that respondents felt they may have been identified by the student researcher if they had included their postcode.

The previous chapter outlined the process of a conservative approach regarding the inclusion of these responses in the analyses. Repeat analysis with the exclusion of these responses of results with borderline significance produced either a similar result of a result indicating significance. Additional analysis was also undertaken in relation to some tests that were significant and the exclusion of these responses did not affect the outcome with regard to significance. The relevant Chi-squared tables for these are in Appendix 7.

Therefore, so as not to bias results towards increasing significance of results from analyses, the responses were included. This is, however, a limitation of the research.

The process of analysis for SAQ data meant that three responses would be included in that analysis (as others were excluded due to missing data). In addition, the responses without postcode data were obviously not included in the analyses relating to geographical location. Hence, a total of 116 eligible surveys were included in the final sample for the variable-based analysis.

According to Health Workforce Data the number of nurses employed in ASGC-RA 3—5 areas in Tasmania 2012 was 1688 (Australian Institute of Health and Welfare, 2013). Thus it may be estimated that the survey responses represent approximately 6.8% of the total population.

This figure is an estimate only as the AIHW indicates caution in relation to its final figures (Australian Institute of Health and Welfare, 2013), and it is also possible that some of the nurses registered work in sites not considered eligible for this study (for example pathology services and medical specialist rooms). In addition, 304 nurses (from a total of 7132) did not indicate remoteness.

The AIHW data also relate to main employment (Australian Institute of Health and Welfare, 2013) and the survey in this study did not indicate whether respondents were working in their main employment or another job. That is, some may have been working in the rural setting as a second job with their main employment in a metropolitan area. More detailed information regarding the representativeness of the survey will be presented with the relevant results.

With regard to frequency data obtained from the questionnaire the demographic information is presented first. This is followed by the frequency of responses received in relation to views of reporting and error acknowledgment and then those relating to safety attitude.

5.3 Demographic data

The frequency of responses to the demographic questions of the survey provide further detail as to the nature of the sample obtained for this research. Responses to each question are presented in graph format with the number (N) indicated with percentage values in brackets. Missing data have been excluded pairwise for this section of the results.

5.3.1 Level of Registration

Figure 5-1 shows the distribution of the participants by level of registration. The majority of respondents were Registered Nurses (92.2%) with 7.8% of respondents being Enrolled Nurses (ENs). This compares with the AIHW data set where 22% of nurses working in ASGC-RA 3—5 areas in Tasmania were ENs (Australian Institute of Health and Welfare, 2013). This suggests that Enrolled Nurses may be under-represented in this sample.

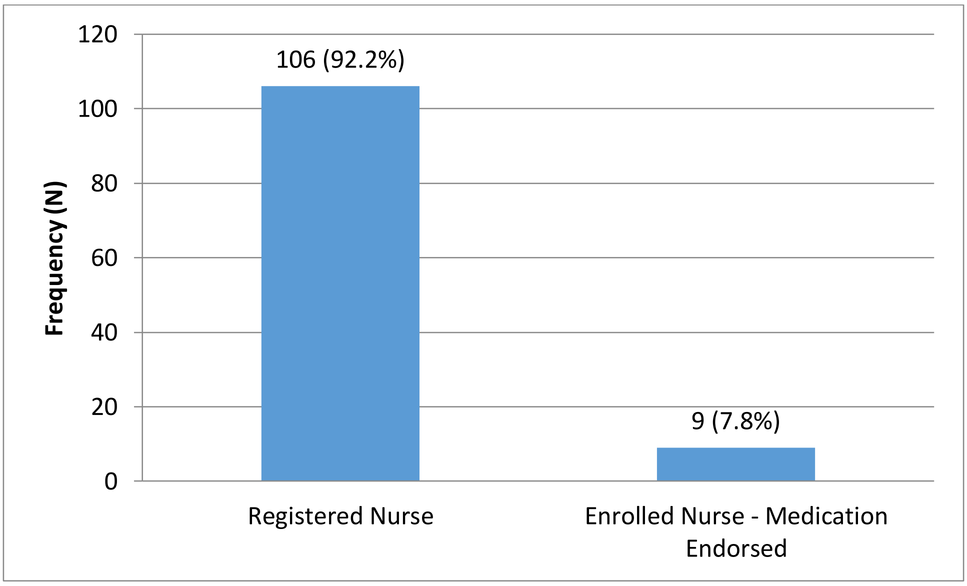

Figure 5-1: Level of registration (*N*=115)

5.3.2 Work location/setting

The work location/setting of respondents is presented in Figure 5-2. Almost half of the respondents (49.5%) work in a hospital or multi-purpose setting. The remainder work in either a residential aged care facility (RACF) (21.7%) or in a community setting (20.9%). Only 7.8% of respondents work in other settings such as general practice, mental health or disability services.

According to the AIHW in 2012 amongst the ASGC-RA 3-5 locations there were 25 666 nurses (not including midwives) working in settings similar to those selected for this research. Of these 65.7% worked in hospitals and 14.5% worked in residential aged care. There were 8.5% working in community health settings with a further 2.9% working specifically in community aged care settings and 2.3% in mental health community settings. There were 5.2% working in general practice. A small percentage worked in residential mental health (0.39%) and alcohol and drug services (0.50%).

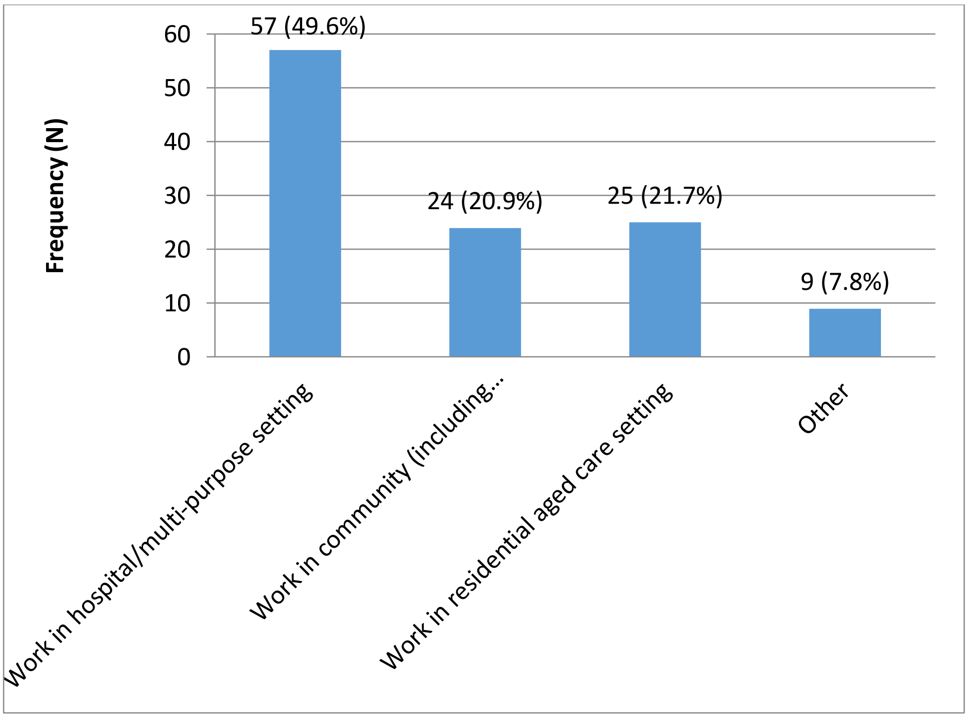

Figure 5-2: Main location of work (*N*=115)

The national nature of the AIHW data set may not reflect the nature of the Tasmanian setting. However, the hospital nurse responses for this research were larger than those in aged care (which in this study also included nurses working in community aged care settings), which were in turn larger than those working in the community settings. With a low number of nurses working in residential mental health and alcohol and drug services it may also explain the low response from nurses in mental health settings for this research. So whilst the representativeness of the sample cannot be specifically identified the trend in the responses reflects the overall trend of the national data set.

5.3.3 Facility bed numbers

It is evident from Figure 5-3 (below) that the majority of respondents work in settings with less than 50 beds (41.2%). Approximately one quarter of respondents (24.6%) work in facilities with 50—99 beds. There were fewer respondents from facilities of 100 beds or more (11.4%) and 3.2% of respondents indicated they were unsure of the number of beds in their facility. This uncertainty may reflect the changes to service provision that were being undertaken by the DHHS at the time the survey was administered as some hospitals were undergoing bed closures. A total of 20.2% of respondents indicated other/not applicable to bed numbers which reflects the nature of worksites in general practice and community settings where workplaces do not have beds.

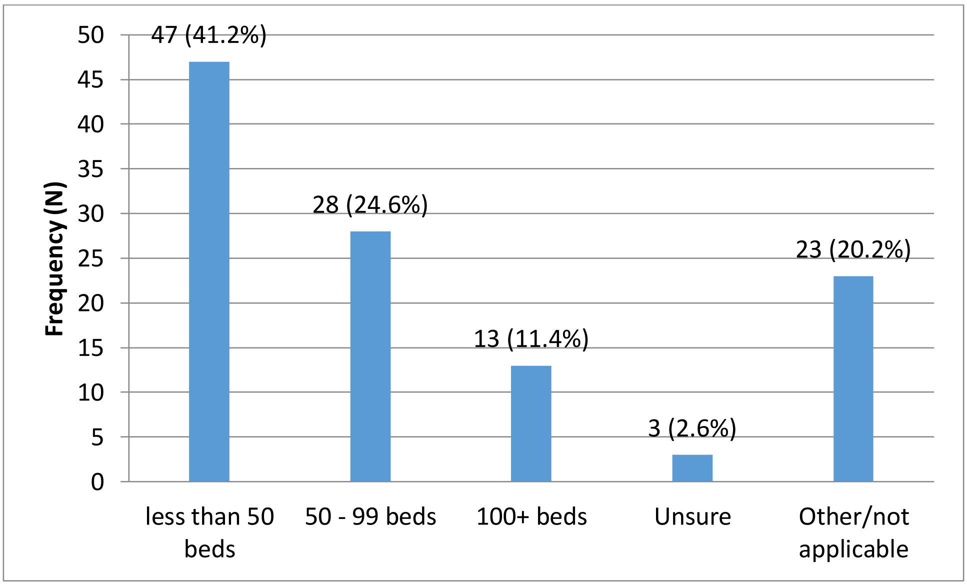

Figure 5-3: Number of beds (*N*=114)

There are no publicly available data regarding nurse employment relative to bed numbers of a facility. Therefore it is not possible to determine the representativeness of these data.

5.3.4 Work role

As indicated in Figure 5-4 (below) the majority of respondents indicated that their work role was clinical (80.7%). This compares to 19.3% who indicated their role was management. It is difficult to determine the representativeness of these data although it is possible that nurses in a management role are over-represented. In Tasmania in 2012 there were 6014 nurses who noted their role as “Clinician” and 176 as “Clinical management’” However, these are state-wide data and as the worksites in rural areas tend to be smaller (as indicated in Figure 4), it is arguable the ratio of managers amongst clinicians would be greater.

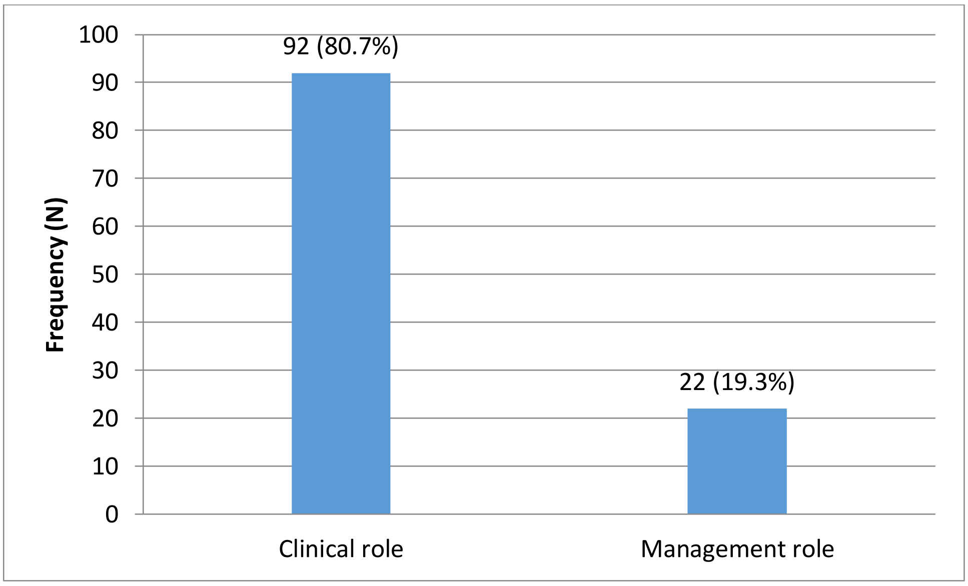

Figure 5-4: Main work role (*N*=114)

It should also be noted that there was a high response rate of managers amongst the nurses working in residential aged care (50%) compared to the other work settings (Appendix 7). The potential impact of this upon the analysis from inferential statistics will be explored further when those results are presented (Sections 5.7.1and 5.8.1).

5.3.5 Employment sector

Figure 5-5 indicates most of the respondents work for government (65.8%) with 33.3% of respondents indicating they work in the non-government/private sector. One respondent (0.9%) indicated they were unsure of the employment sector they were working in. Whilst this may seem unusual the nature of funding for some centres in Tasmania may lead to this type of uncertainty. Several centres, such as Esperance and Tasman Multi-purpose services have been operated by both public and private sector entities.

It is difficult to determine the representativeness of the sample in relation to the employment sector. These data are reported by AIHW on a state level and in Tasmania in 2012 there were 4269 nurses employed in the public sector and 3081 in the private sector. These figures suggest the Non-government workforce may be under-represented in the sample obtained for this research. This possibility reflects a similar observation from research conducted by ACSQHC where there was also a low response rate from the private sector was also.

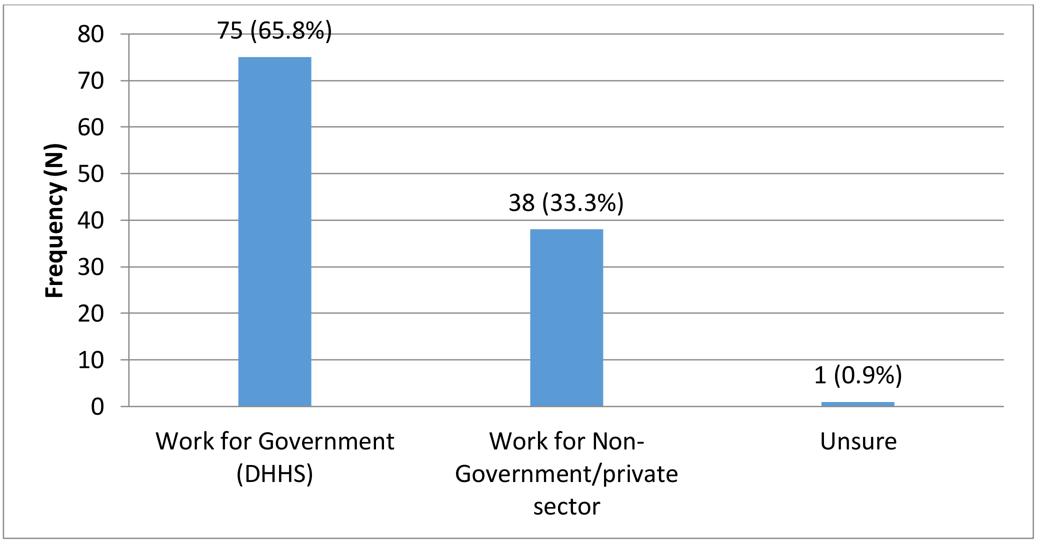

Figure 5-5: Employment sector (*N*=114)

5.3.6 Experience in current workplace

As indicated in Figure 5-6, almost one third of respondents indicated they had worked in the current workplace from 3 years to less than 8 years (31.3%) and 17.4% had worked in the same workplace for 21 years or more. A small number of respondents indicated they had been in their current workplace for less than 6 months (2.6%) or from 6 months to less than 1 year (4.3%). The remainder of respondents had been working in their current workplace for 1 year to less than 3 years (16.5%), from 8 years to less than 13 years (14.8%) or from 13 years to less than 21 years (13.0%).

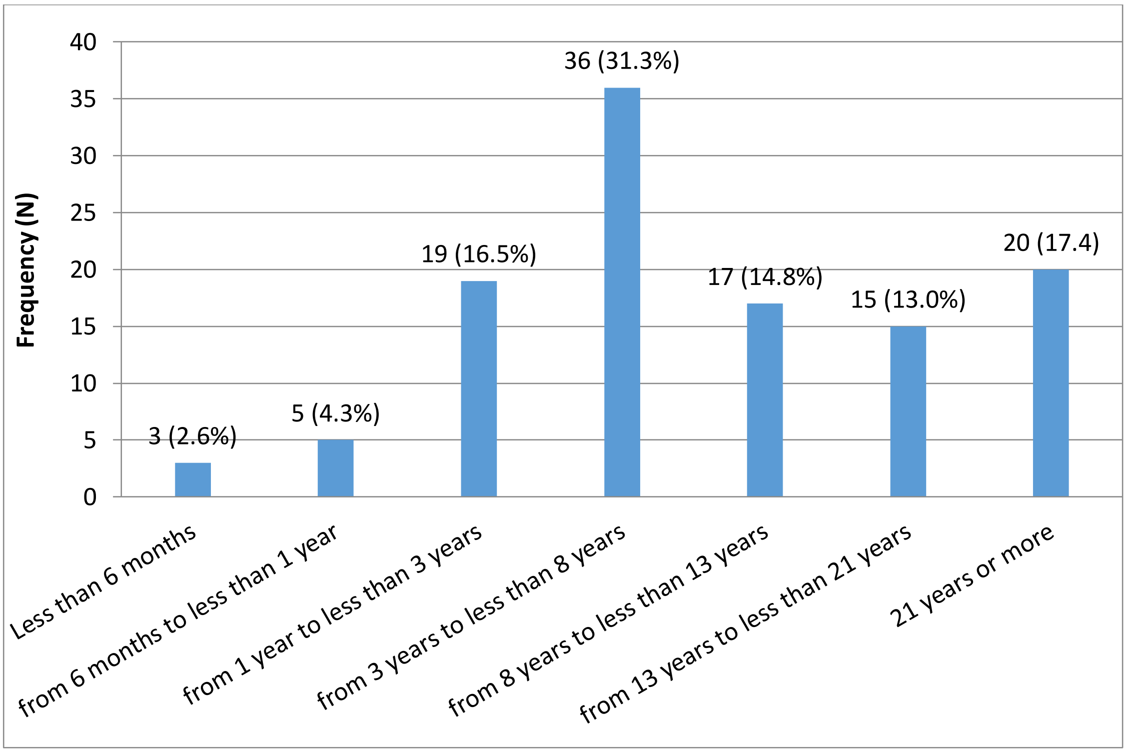

Figure 5-6: Experience in current workplace (*N*=115)

5.3.7 Experience in nursing

More than half of the respondents have worked in nursing for 21 years or more (57.4%) and as Figure 5-7 indicates almost one third of respondents have worked in nursing from 3 years to less than 8 years (31.3%). Approximately half this number have worked in nursing for either 8 years to less than 13 years (14.8%) or from 13 years to less than 21 years (13.0%).

Figure 8 also indicates a small number of responses from nurses with less than 6 months (1.7%) or from 1 year to less than 3 years (1.7%) experience in nursing. There were no respondents indicating experience in nursing of 6 months to less than 1 year. Whilst AIHW collects data on the age of nurses there are no specific data collected in relation to experience in nursing or experience in current workplace.

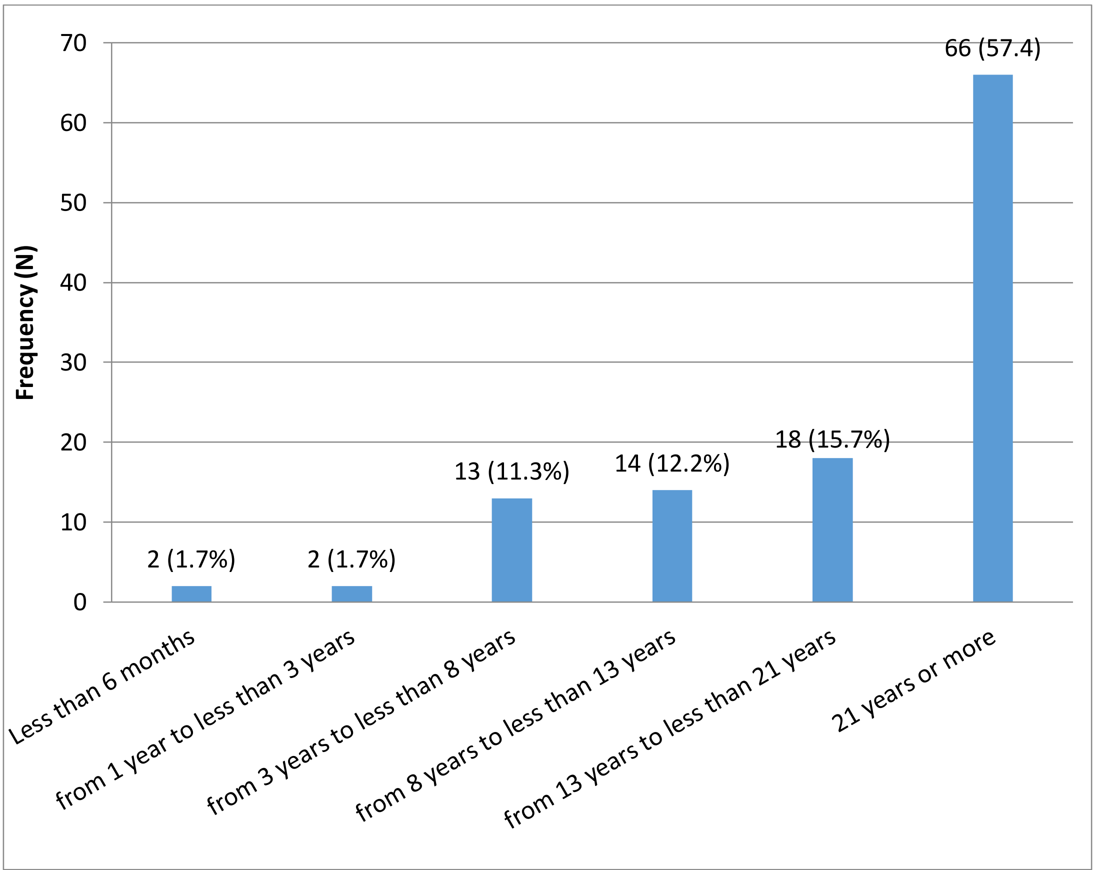

Figure 5-7: Experience in nursing (*N*=115)

Of the 7132 nurses registered in Tasmania in 2012 there were 4 178 (59%) who were aged 45 or older. Whilst not all nurses in this age group may necessarily have been employed in nursing for their whole working, it is arguable that the majority have. This suggests that the 57% of respondents who had worked for 21 years or more is representative of the nursing workforce in Tasmania.

5.3.8 Rurality

A large majority of respondents indicated that they worked in an outer regional (ASGC-RA 3) location (92.8%). This compares with 4.5% of respondents working in a remote location (ASGC-RA 4) and 2.7% working in very remote (ASGC-RA 5) areas. This is shown in Figure 5-8. The AIHW data indicates that in 2012 of the enrolled and registered nurses working in the ASGC-RA 3-5 areas in Tasmania 88.7% were working in an ASGC-RA 3 area, 8.6% were working in ASGC-RA 4 and 2.7% in ASGC-RA 5. This suggests that an ASGC-RA 3 areas may be over-represented whilst ASGC-RA 4 areas may be under-represented.

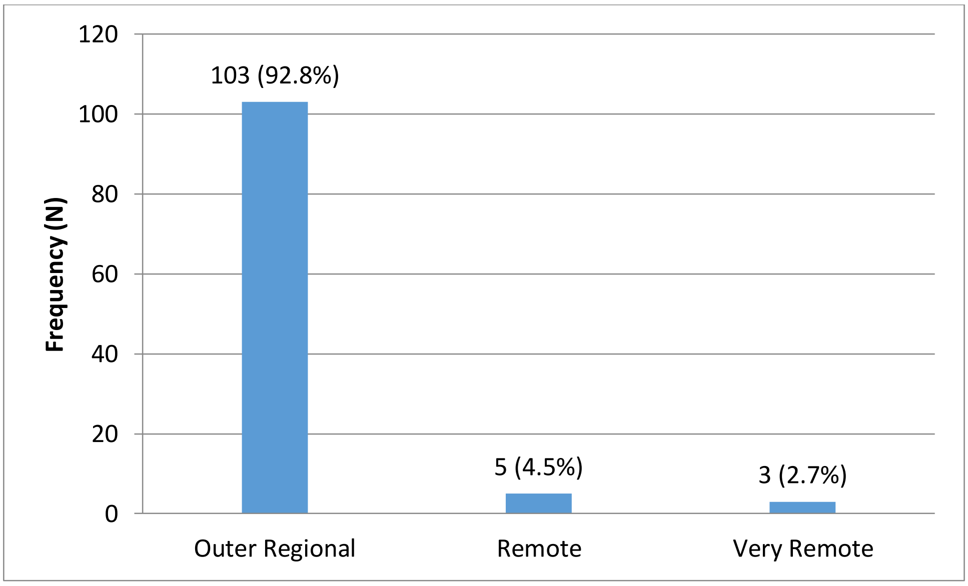

Figure 5-8: ASGC-RA (*N*=111)

5.3.9 Region

The responses from each regional area of Tasmania are shown in Figure 5-9. More than half of the respondents worked in settings situated in the north-west of the state (55.0%) with 26.1% of respondents working in the north and 18.9% of respondents working in settings located in the south. The geographical location of facilities in Tasmania explains this unusual result. The larger hospitals in the north and north-west regions are located in centres in ASGC-RA 2 (outer regional) settings. Hence they were excluded whilst the three larger facilities in the north - west region remained in the sample.

It is not possible to make a comparison with AIHW data in this instance as the ASGC-RA is the recognised classification for location. Regional data were collected as at the time there were three regional health areas operating within the Tasmanian public health system.

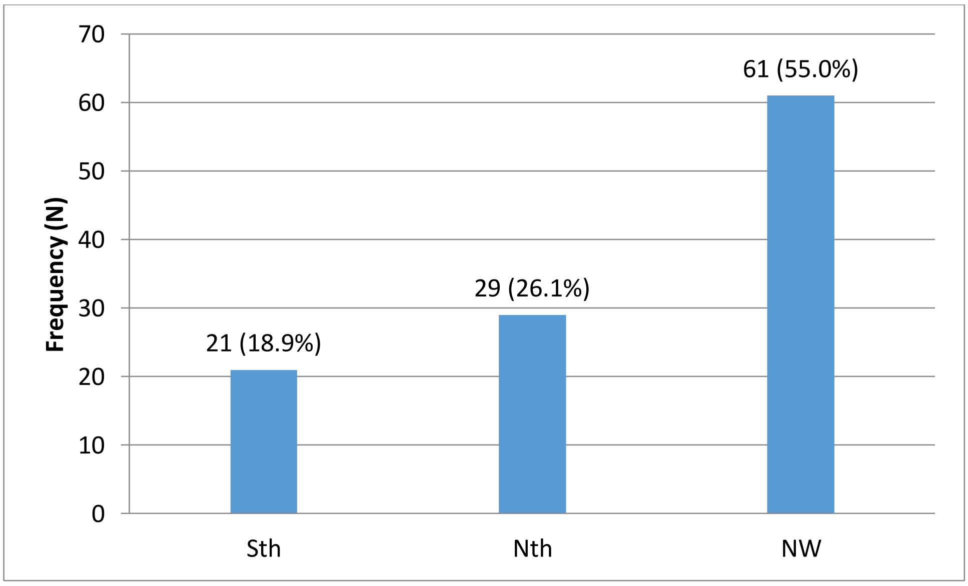

Figure 5-9: Region (*N*=111)

5.3.10 Summary of sample

Having examined the demographic information obtained for this research, it is clear that caution is required when determining the representativeness of the sample. Whilst comparison may be made with the data obtained from the AIHW several areas have been noted as potentially problematic in terms of representativeness. This includes possible under-representation of enrolled nurses in the sample as well as nurses in a clinical role. The private sector is not well represented although this has been noted in other studies. Work locality may not be reflective of national data with regards to ASGC-RA and it is not possible to compare region data with a national data set as one is not available.

The experience level of nurses and the workplace settings indicated amongst the sample, whilst not directly comparable to AIHW data do reflect similar trends in terms of representativeness. With regard to facility bed numbers it is difficult to determine representativeness as there is no national data set of this information. These elements need to be kept in mind when considering the results obtained for this research. It may be that the sample is not representative of the broader population. However, with regard to rural clinical settings in Tasmania these are the only known data on views of reporting or acknowledgment of error, teamwork and safety climate amongst nurses.

The low number responses in some of the variables above lead to combining of results where possible. This included merging responses for ASGC-RA 4-5 resulting in two categories of *outer regional* and *remote/very remote.* This allowed for reducing the number of cells with counts less than five so as to improve the Chi-squared analysis.

In the situation of the responses to facility bed numbers and employment sector there were some 3 and 1 respondents respectively who indicated their answer as *Unsure.* It was not possible to combine these data with another response category so these respondents were excluded from the Chi-squared analysis.

There were nine respondents indicating their worksite as *other* including responses from mental health, general practice and disability service worksites. With such diversity in this group of responses comparing these responses with the other groupings was unlikely thus they were excluded from variable-based analyses that related to workplace setting (Sections 5.7.1and 5.8.1).

5.4 Frequency: Views of reporting and disclosure

This section presents the results relating to views of reporting and disclosure of error. The results therefore relate to the first research sub-question which is: *what level of reporting and disclosure of different severity of a hypothetical medication error do nurses in rural clinical settings think is occurring?*

Views of reporting and disclosure in relation to error severity amongst respondents are presented in Figure 5-10 and Figure 5-11. Figure 5-10 shows the views of reporting of whilst Figure 5-11 indicates the views of disclosure.

Although 80.2% (n= 85) of respondents indicated the likelihood that the severe error would *Always* be reported in their workplace, 9.4% (n=10) indicated such an error would *Never* be reported with 4.7% (n=5) indicating such an error would *Usually* be reported, 1.9% (n=2) indicating it would *Sometimes* be reported and 3.8% (n=4) indicating it would *Rarely* be reported.

Compared to a view of reporting severe error, fewer respondents (64.8%, n=68) indicated the moderate error scenario would *Always* be reported. There were 19.0% (n=20) of respondents indicating such an error would *Usually* be reported, 3.8% (n=4) indicating *Sometimes*, 10.5% (n=11) indicating *Rarely* and 1.9% (n=2) felt such an error would *Never* be reported.

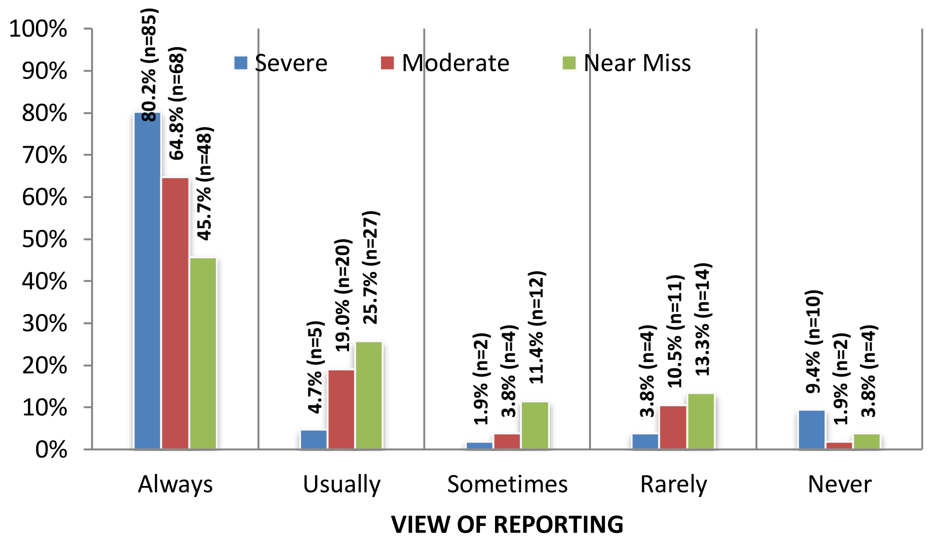

Figure 5-10: Views of reporting error

In relation to the near miss scenario less than half (45.7%, n=48) of the respondents indicated that such an error would *Always* be reported and 3.8% (n=4) indicated it would *Never* be reported. Approximately one quarter of respondents (25.7%, n=27) felt that the near miss would *Usually* be reported in their worksite with 11.4% (n=12) indicating *Sometimes* and 13.3% (n=14) indicating such an error would *Rarely* be reported.

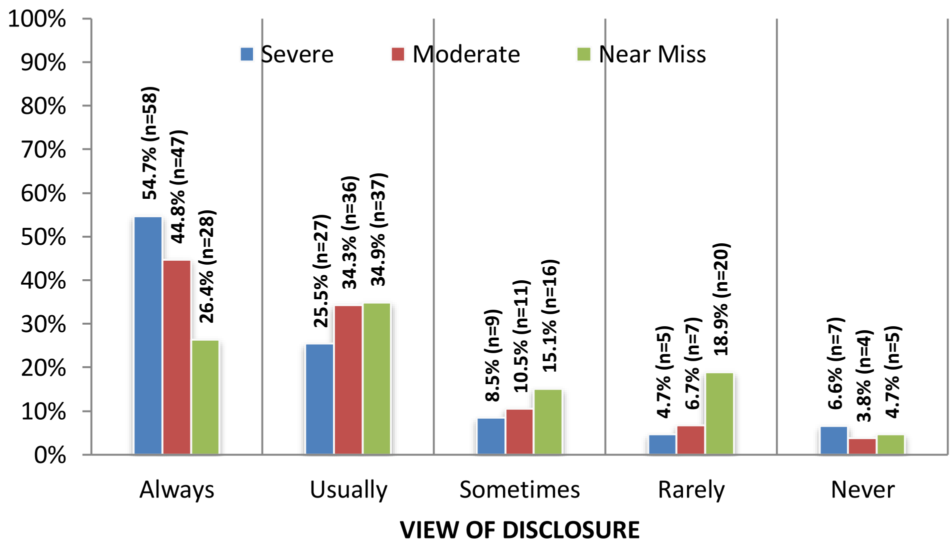

Figure 5-11: Views of error disclosure

Respondent views of disclosing the severe, moderate and near miss error scenario are presented in Figure 5-11. The use of an axis to 100% is deliberate so that the graphs can be easily compared with the results for views of error reporting.

The number of respondents indicating that the severe error scenario would *Always* be acknowledged to the patient and/or their family was 54.7% (n=58). Almost one quarter (25.5%, n=27) of respondents indicated such an error would *Usually* be disclosed, 8.5% (n=9) indicated *Sometimes*, 4.7% (n=5) indicated *Rarely* and 6.6% (n=7) indicated such an error would *Never* be disclosed.

Less than half of respondents (44.8%, n=47) indicated that the moderate error scenario would *Always* be disclosed. Approximately one third (34.3%, n=36) indicated that the moderate error would *Usually* be disclosed, with 10.5% (n=11) indicating *Sometimes*, 6.7% (n=7) indicating *Rarely* and 3.8% (n=4) indicating *Never*.

Responses for the near miss error scenario indicate that just 26.4% (n=28) agreed this outcome would *Always* be disclosed. More than this (34.9%, n=37) indicated the scenario would *Usually* be disclosed. Responses for *Sometimes*, *Rarely* and *Never* were 15.1% (n=16), 18.9% (n=20) and 4.7% (n=5) respectively.

Examination of Figure 5-10 and Figure 5-11 suggests there are differences between the frequency of views the error would *Always* be reported when compared to the error of the same level of harm would be viewed as likely to *Always* be disclosed. Furthermore, the views regarding the likelihood the error would *Always* be reported or disclosed decreased as severity of harm decreased.

Chi-squared Goodness of Fit Tests were undertaken to compare comparing results that the error would *Always* be reported or disclosed. The relevant results tables from these tests appear in Appendix 9.

Severe error was more likely to be reported than disclosed (χ^2=31.745, df=1, N=115, p=0.000), as was moderate error (χ^2=20.386, df=1, N=114, p=0.000) and the near miss outcome (χ^2=21.618, df=1, N=114, p=0.000). Severe error was more likely to be reported than moderate error ($\chi^2$13.075, df=1, N=115, p=0.000) or near miss error (χ^2 18.513, df=1, N=115, p=0.000) with moderate error also more likely to be reported than near miss (χ^2=18.513, df=1, N=114, p=0.000). Similarly severe error was more likely to be disclosed than moderate error (χ^2=3.895, df=1, N=115, p=0.048) or near miss ($\chi^2$44.736, df1, N=115, p=0.000) with moderate error also more likely to be disclosed than the near miss scenario ($\chi^2$18.847, df=1, N=113, p=0.000).

Differences found in the frequency of views of error reporting and disclosure amongst nurses relating to the demographic data will be presented in Sections 5.7.1 and 5.7.2 of this chapter. Further frequency data obtained in relation to safety climate will be considered first.

5.5 Frequency: teamwork and safety climate

The first section of the questionnaire obtained data with respect to safety attitude through use of the SAQ. The frequency of responses to this section will now be presented.

Table 5-1 and Table 5-2 outline the frequency data obtained in relation to the *Safety Attitudes Questionnaire* (SAQ). *Items 2, 6, 18* and *23* are negatively worded. In most items the majority of respondents indicated they *agreed strongly* or *agreed slightly* to the statements. The opposite was the case for the negatively worded items where the majority of respondents indicated they either *disagreed strongly* or *disagreed slightly* with the item statement.

Responses to the teamwork items of the SAQ are presented in Table 5-1. Responses can be grouped into two clear categories. The first group consisting of *Items 1, 3, 8, 9, 11* and *14* there were over 60% or greater of respondents indicating they *agreed strongly* in relation to the particular statement. Of the respondents, 64.6% indicated they *agreed strongly* that nurse input was well received (*Item 1*).

Table 5-1 *Frequency SAQ Teamwork Questions*

	Disagree Strongly* % (N)	Disagree slightly* % (N)	Neutral* % (N)	Agree Slightly* % (N)	Agree strongly* % (N)	N/A# % (N)
1. Nurse input is well received where I work	4.4 (5)	1.8 (2)	5.3 (6)	23.9 (27)	64.6 (73)	
2. Where I work it is difficult to speak up if I perceive a problem with patient care	55.8 (63)	25.7 (29)	1.8 (2)	13.3 (15)	3.5 (4)	
3. Decision making where I work uses input from relevant staff	4.6 (5)	6.4 (7)	4.6 (5)	22.9 (25)	61.5 (67)	
4. The doctors and nurses here work together as a well-coordinated team	0.9 (1)	10.1 (11)	9.2 (10)	35.8 (39)	44.0 (48)	2.7 (3)
5. Disagreements where I work are resolved appropriately (i.e. not who is right but what is best for the patient)	5.4 (6)	13.5 (15)	9.9 (11)	27.9 (31)	43.2 (48)	
6. I am frequently unable to express disagreement with the senior clinical staff here	33.6 (36)	40.2 (43)	8.4 (9)	11.2 (12)	6.5 (7)	3.6 (4)
7. It is easy for staff here to ask questions when there is something they do not understand	33.6 (36)	40.2 (43)	8.4 (9)	11.2 (12)	6.5 (7)	3.6 (4)
8. I have the support I need from other staff to care for patients	0.9 (1)	11.6 (13)	3.6 (4)	16.1 (18)	67.9 (76)	
9. I know the first and last names of all the staff I worked with during my last shift	1.8 (2)	1.8 (2)	0.9 (1)	6.4 (7)	89.0 (97)	
10. Important issues are well communicated at shift changes	2.9 (3)	9.5 (10)	3.8 (4)	29.5 (31)	54.3 (57)	
11. Briefing staff on handovers between shifts/periods of work (i.e. to plan for possible contingencies) is important for patient safety	0.0 (0)	0.9 (1)	0.9 (1)	5.5 (6)	92.7 (102)	
12. Briefings are common where I work	2.7 (3)	7.2 (8)	9.9 (11)	33.3 (37)	46.8 (52)	
13. I am satisfied with the quality of collaboration that I experience with senior doctors where I work	5.7 (6)	6.6 (7)	8.5 (9)	33.0 (35)	46.2 (49)	
14. I am satisfied with the quality of collaboration that I experience with nurses where I work	0.0 (0)	8.0 (9)	5.4 (6)	25.9 (29)	60.7 (68)	

**Valid percent (not including N/A)*

#N/A result is for total % (N) in overall sample

There were 61.5 % of respondents indicating that they *agreed strongly* that decision making in their workplace used input from relevant staff (*Item 3*), 22.9% *agreed* *slightly* and 4.6% indicated a *neutral* response. Those in *slight disagreement* were 6.4% of responses with 4.6% in *strong disagreement*.

A total of 67.9% felt they had support from other staff to care for their patients (*Item 8*) and 16.1% were in *slight agreement* with this item. Although only 0.9% were in *strong disagreement*, there were 11.6% of responses *disagreeing slightly*. There were 3.6% of responses *neutral* to this item.

A large number of respondents (89.0%) *agreed strongly* that they knew the first and last names of the people they worked with on their last shift (*Item 9*) and 6.9% *agreed slightly*. Only 0.9% of responses received were *neutral* for this item with 1.8% each received for both *slight* and *strong disagreement*.

There were 60.7% of respondents who *agreed strongly* that they were happy with the degree of collaboration where they worked (*Item 14*) compared with 25.9% in *slight agreement*, 5.4% *neutra*l and 8% in *slight disagreement*. No responses were received indicating *strong disagreement* with this statement.

A total of 92.7% of respondents *strongly agreed* that briefings are important for patient safety (*Item 11*) which was the highest response received in relation to an item. Just 5.5% *agreed slightly* on this item with 0.9% either *neutral* or *slightly disagreeing*. There were no responses indicating *strong disagreement* for this item.

These results contrast with the second group containing Items *4, 5, 10, 12* and *13* where the percentage of respondents was more evenly distributed across both *slight* and *strong agreement*. The number of respondents who *agreed strongly* to the relevant item statements was below 55% in these questions and in some cases less than 50%. However, with the exception of *Item 10* the number of respondents *agreeing slightly* with the statements of each question was over 30%.

Whilst 44% of respondents indicated they *agreed strongly* that doctors and nurses worked together as a well-coordinated team there were 35.8% that *agreed slightly* with this statement. Similarly 43.2% of respondents were *agreed strongly* that there was an appropriate resolution to disagreements in their workplace with 27.9% indicating that they *agreed slightly*.

Respondents to *Item 10* showed 54.3% *agreed strongly* and 29.5% *agreed slightly* that important issues are well communicated at shift changes. Whilst 3.8% of responses were *neutra*l to this item there were 9.5% who *slightly disagreed* and a further 2.9% indicating *strong disagreement*. Therefore 12.4% (almost one in eight) of respondents do not agree that communication is adequate at shift changes.

In relation to briefings in the workplace being common (*Item 12*) 46.8% *agreed strongly* and 33.3% *agreed slightly* to this. However, 9.9% of respondents indicated a *neutral* view to this item with 7.2% in *slight disagreement* and 2.7% *strongly disagreeing*.

The quality of collaboration with nurses in the workplace (*Item 14*) was considered satisfactory by most respondents with 60.7% in *strong agreement* and 25.9% in *slight agreement*. There were no responses in *strong disagreement* with this item although 8% *slightly disagreed* and 5.4% were *neutral* in their response.

The first of the two negatively worded questions (*Item 2*) indicating difficulty in speaking up around perceived problems with patient care returned a response of 55.8% *disagreeing strongly* and 25.7% *disagreeing slightly*. That is, the large majority of respondents did not feel this is an issue in their workplace.

The responses to *Item 6*, regarding feeling unable to indicate disagreement with senior staff indicate that 33.6% of staff *disagreed strongly* and 40.2% *disagreed slightly*. That is, allowing for the negative wording, the majority of respondents felt able to disagree with senior staff in their workplace.

What is of concern in relation to this question is that *Item 7*, which is not negatively worded, returned the same results as *Item 6* across all possible choices. Previous studies using the SAQ have suggested that respondents may not correctly read negatively worded questions. However, the results in this study may not necessarily reflect this as *Item 7* responses indicate that 33.6% of staff *disagree strongly* that they are able to ask questions when there is something they do not understand with 40.2% *disagreeing slightly*. It seems somewhat unusual that respondents would feel this way yet feel able to disagree with senior clinical staff. Therefore, the results of both *Item 6* and *Item 7* should be interpreted with caution.

Respondents who indicated *N/A* were excluded pairwise from this analysis. However, the % (N) total in the overall sample is noted in Table 5-2. Of the 14 items relating to teamwork there were only three where respondents indicated *N/A*.

Results in relation to the safety climate section of the SAQ as presented in Table 5-2 are quite different compared to the teamwork questions. There were fewer items returning a response of greater than 60% *strong agreement* with only *Items 17, 22* and *24* returning this level of agreement.

With respect to being encouraged by their colleagues to report safety concerns (*Item 17*), 69.1% indicated *strong agreement* and 23.6% *slight agreement*. Only 2.7% indicated *strong disagreement* with the same response also present for *slight agreement*. There were 1.8% of respondents neutral to this question.

A larger percentage, 82.3%, indicated they strongly agreed they knew the proper channels through which to report error (*Item 22*) and 15% *indicated slight agreement* with this statement. No respondents (0%) indicated they *disagreed slightly* and just one respondent (0.9%) indicated they *strongly disagreed*. Once again 1.8% of respondents indicated a *neutral* position to this question.

There were 64% of respondents who indicated they strongly agreed that management did not knowingly compromise the safety of patients (*Item 24*), 13.5% who *agreed slightly* and 7.2% indicating a neutral response. Of concern is that 7.2% and 8.1% of respondents indicated they *disagreed strongly* or *disagreed slightly* respectively. Thus 15.3% of respondents felt management in their workplace knowingly compromised the safety of patients.

Table 5-2 *Frequency SAQ Safety climate questions*

	Disagree Strongly* % (N)	Disagree slightly* % (N)	Neutral * % (N)	Agree Slightly* % (N)	Agree strongly* % (N)	N/A# % (N)
15. The levels of staffing where I work are sufficient to handle the number of patients	9.8 (11)	23.2 (26)	6.3 (7)	29.5 (33)	31.3 (35)	0.9 (1)
16. I would feel safe being treated as a patient in this service	2.7 (3)	6.2 (7)	8.0 (9)	27.4 (31)	55.8 (63)	
17. I am encouraged by my colleagues to report any patient safety concerns I may have	2.7 (3)	2.7 (3)	1.8 (2)	23.6 (26)	69.1 (76)	1.8 (2)
18. Staff frequently disregard rules or guidelines (e.g. hand-washing, treatment protocols/clinical pathways etc.) that are established for the area where I work	46.4 (52)	28.6 (32)	3.6 (4)	15.2 (17)	6.3 (7)	0.9 (1)
19. The culture where I work makes it easy to learn from the errors of others	9.8 (11)	7.1 (8)	15.2 (17)	36.6 (41)	31.3 (35)	0.9 (1)
20. I receive appropriate feedback about my performance	10.6 (12)	9.7 (11)	15.9 (18)	27.4 (31)	36.3 (41)	
21. Medical errors are handled appropriately here	4.5 (5)	5.5 (6)	9.1 (10)	30.0 (33)	50.9 (56)	2.7 (3)
22. I know the proper channels to which I should direct questions regarding patient safety	0.9 (1)	0.0 (0)	1.8 (2)	15.0 (17)	82.3 (93)	
23. Where I work it is difficult to discuss errors	46.0 (52)	25.7 (29)	8.0 (9)	15.0 (17)	5.3 (6)	
24. Management does not knowingly compromise the safety of patients	7.2 (8)	8.1 (9)	7.2 (8)	13.5 (15)	64.0 (71)	0.9 (1)
25. This organisation is doing more for patient safety than it did one year ago	6.5 (7)	10.2 (11)	21.3 (23)	27.8 (30)	34.3 (37)	4.4 (5)
26. Leadership is driving us to be a safety-centred organisation	6.3 (7)	7.1 (8)	17.0 (19)	24.1 (27)	45.5 (51)	0.9 (1)
27. My suggestions about safety would be acted upon if I expressed them to management	6.2 (7)	8.0 (9)	6.2 (7)	28.3 (32)	51.3 (58)	

**Valid percent (not including N/A)*

#N/A result is for total % (N) in overall sample

Whilst 55.5% of respondents *agreed strongly* that they would feel safe being treated as a patient in the health service (*Item 16*) and 27.4% agreed slightly there were 8% of respondents who were *neutral* on this item. Of concern is that 6.2% *disagreed slightly* with this item and 2.7% *disagreed strongly*. Thus almost 9% of respondents felt they would not be safe as a patient in their own health service.

In relation to work culture making it easy to learn from the errors of others (*Item 19*) there were only 31.3% of the respondents who were in *strong agreement* and 36.6% *slightly agreed*. The percentage of respondents who *neither agreed nor disagreed* with this item was 15.9%. Respondents who *slightly disagreed* were 7.1%, and 9.8% were in *strong disagreement*. That is, 16.9% of respondents disagreed with the item, which by comparison to other items is relatively high for an item not negatively worded.

A similar high rate of disagreement was found in responses to *Item 20*. There were 10.6% of respondents who *disagreed strongly* that they received appropriate feedback about their performance and 9.7% who *slightly agreed* with this item. This indicates approximately one in five respondents felt they do not receive appropriate feedback about their performance. There were 15.9% of respondents who were *neutral* on this item. In relation to agreement with the item, 27.4% of respondents *agreed slightly* and 36.3% *agreed strongly*.

Agreement regarding the appropriate handling of medical error (*Item 21*) was high overall. Whilst just over half (50.9%) of the respondents *agreed strongly* with this item, 30.0% *agreed slightly*. There were 9.1% of respondents who were neutral and 5.5% and 4.5% indicating *slight disagreement* and *strong disagreement* respectively.

Of the responses to the statement that their organisation was doing more for patient safety than it did one year ago (*Item 25*), 34.3% *agreed strongly* and 27.8% *agreed slightly*. This item received the highest rate of *neutral* responses for any item with 21.3% of nurses indicating this. There were 10.2% of respondents who *agreed slightly* and 6.5% who *disagreed strongly* with this item.

There were 45.5% of respondents who *strongly agreed* that leadership was driving their organisation to be safety centred (*Item 26*) and 24.1% *agreed slightly* with this. Of the respondents who *disagreed,* 7.1% did so *slightly* and 6.3% were in *strong disagreement*. There were 17% of respondents indicating a *neutra*l view on this item.

For the final item of the SAQ section of the questionnaire relating to whether or not their suggestions about safety would be acted upon if expressed to management (*Item 27*), 51.3% of respondents *strongly agreed* and 28.3% *agreed slightly*. There were 6.2% of respondents who were *neutral*, 8.0% who *disagreed slightly* and 6.2% who *disagreed strongly* with this item.

The negatively worded items in this section of the SAQ were *Items 18* and *23*. The first of these (*Item 18*) relates to staff frequently disregarding rules or guidelines and 46.4% of respondents indicated they *disagreed strongl*y with this statement. There were 28.6% of respondents who *disagreed slightly* and just 3.6% who indicated a *neutral* response. However there were 6.3% of respondents who *agreed strongly* that staff frequently disregarded rules or guidelines and 36.6% *agreed slightly* with the statement.

In relation to difficulty discussing errors in the workplace (*Item 23*) 46.0% of respondents *disagreed strongly* that it was difficult to do so in their workplace and 25.7% *disagreed slightly*. There were 8% of respondents who were *neutral* to the statement with 15.0% *agreeing slightly* and 5.3% *agreeing strongly*.

The number of respondents indicating *N/A* for any item is reported in Table 5-2. Of the 13 items there were eight where respondents indicated this.

Although the frequency results of this research are not identical to those obtained by a previous study using the same questionnaire (Hutchinson et al., 2006) there is a similarity in that the majority of respondents indicated agreement with item statements, with the reverse occurring for negatively worded items. In contrast this research had comparatively fewer respondents indicating a *neutral* or *N/A* response to items.

5.6 Principal components analysis (PCA)

A previous study in the UK using the same wording of the SAQ found five factors, two for teamwork and three for safety climate (Hutchinson et al., 2006). Use of

Cronbach's α is recommended in order to check the reliability of a scale (Pallant, 2013). When this was done one of the factor scales was found to have a value of less than 0.70, which indicates a lack of reliability. The Cronbach's α factor scores for the previous study compared to the data obtained in this research appear in Appendix 10.

An exploratory principal components analysis (PCA) was therefore undertaken in order to extract factors resulting in a reliable scale that could then be applied as conditions in QCA. It also identified the conditions to be used for QCA.

The steps taken for PCA were outlined in Chapter 4 (Section 4.3.3). The three steps involved considering the suitability of the data, factor extraction and rotation of factors. The results from this process are outlined here and the SPSS outputs for the final analysis appear in Appendix 12.

5.6.1 Data suitability

As discussed in earlier in this chapter (Section 5.2), there were 116 responses received from the survey. This was slightly under the recommended minimum of five responses per question for the 27 questions from the SAQ in the first part of the survey. However, as previous applications of the SAQ had identified two elements of teamwork (*Items 1—14*) and safety climate (*Items 15—27*), the survey items were analysed in relation to these two elements. This meant that a minimum of 70 responses was required and therefore the minimum number of responses recommended was easily met.

Data were found not to be normally distributed. The SPSS outputs for this analysis appear in Appendix 6. Although not ideal, principal components analysis is considered robust enough for non-normally distributed data to be used (Tabachnick & Fidell, 2007).

5.6.2 Factor extraction

Determining the number of factors to extract within each of the two elements was then undertaken. Oblique rotation (Direct Oblimen) was adopted. This approach resulted in factors that could be grouped and described in a meaningful way. Whilst this is the same survey that was used in the UK, it should be noted that the factors extracted are not identical to those identified through previous use (Hutchinson et al., 2006). Discussion regarding this appears in (Section 6.1).

Initial analysis resulted in a matrix for teamwork that was not positive definite. Hence there was no result for the Kaiser-Meyer-Olkin and Bartlett's Test of Sphericity for this element. This indicated there was no correlation between the data relating to these items. The initial analysis for safety climate questions returned a matrix that was positive definite suggesting an underlying correlation was present.

Frequency data for the responses to teamwork questions identified concerns in relation to *Items 6 and 7*. These have been addressed in Section 5.5. The non-retention of these items for the analysis resulted in a matrix that was also positive definite. Both elements were then taken through the further steps of PCA factor extraction.

Table 5-3 outlines the results for the KMO and Bartlett's Test of Sphericity. In each case the KMO was greater than 0.7 (0.834 for teamwork and 0.844 for safety climate) and the Bartlett's Test of Sphericity indicated significance ($p=0.000$).

The Kaiser Criterion (identifying Eigenvalues of ≥1) and Catell's Scree Test for each of the elements were not conclusive. It was difficult to ascertain whether two or three factors should be extracted, particularly in relation to the teamwork questions. Similar issues were identified in a previous use of this questionnaire (Hutchinson et al., 2006). Scatter plots for each analysis may be found in Appendix 12.

The pattern matrix in particular was evaluated through the process of PCA. It identified that removal of some questions with low Eigenvalue scores may be necessary.

Parallel analysis was therefore used to finalise the number of factors that should be extracted. The Monte Carlo PCA tables produced for Horne's Test during this analysis appear in Appendix 12. These tables suggested one factor be extracted for teamwork and two for safety climate. The final tables presented for the thesis relate to the final analysis where 11 questions were retained for each of the elements of teamwork and safety climate.

Table 5-3 *Factors identified from PCA*

Factor	KMO (approx. χ^2)	Bartlett's Test of Sphericity	Number of items	Valid % (N)	Number of responses excluded[a]	Item Mean	Cronbach α	Total variance explained (%)
Teamwork Factor 1 Teamwork and patient safety at bedside	0.834 (438.041)	df=55 p=0.000	7	86.2 (100)	16	4.257	0.841	43.82
Teamwork Factor 2 Workplace relationships and communication			4	87.9 (102)	14	4.299	0.697	12.30
Safety Climate Factor 1 Workplace safety culture	0.844 (491.110)	df=55 p=0.000	4	95.7 (111)	5	4.011	0.721	13.54
Safety Climate Factor 2 Leadership and error management			7	92.2 (107)	9	4.096	0.853	43.83

[a]Listwise exclusion

Following the above processes four factors were extracted with two for each of the elements of teamwork and safety climate. These are listed in Table 5-3. The total variance explained for each teamwork factor was 43.82% for *teamwork and patient safety at bedside,* and 12.30% for *workplace relationships and communication,* whereas it was 13.54% for *workplace safety culture* and *43.83%* for *leadership and error management.*

It has already been noted that non retention of *Items 6* and *7* of the teamwork element was required. Based upon the experience of a previous use of the survey where it was determined *Item 11* reflected an observation rather than an attitude this item was also not retained (Hutchinson et al., 2006). The negatively worded questions in the safety climate element (*Items 18* and *23*) were also not retained as was also the case in a previous use of the SAQ (Hutchinson et al., 2006).

Table 5-4 *Optimum factor loadings for teamwork items*

Teamwork items	***Teamwork Factor 1*** **Teamwork and patient safety at bedside**	***Teamwork Factor 2*** **Workplace relationships and communication**
1. Nurse input is well received where I work	.614	
2. Where I work it is difficult to speak up if I perceive a problem with patient care	.823	-.442
3. Decision making where I work uses input from relevant staff	.693	
5. Disagreements where I work are resolved appropriately (i.e. not who is right but what is best for the patient)	.597	
8. I have the support I need from other staff to care for patients	.792	
10. Important issues are well communicated at shift changes	.698	
14. I am satisfied with the quality of collaboration that I experience with nurses where I work	.760	
4. The doctors and nurses here work together as a well-coordinated team		.820
9. I know the first and last names of all the staff I worked with during my last shift		.365
12. Briefings are common where I work		.465
13. I am satisfied with the quality of collaboration that I experience with senior doctors where I work		.824

Once the items and factors were finalised, the reliability of each of these was assessed through use of Cronbach's α. The results from this process are also noted in Table 5-3.

It is generally regarded that a result of 0.70 or higher suggests a scale is reliable (Flin et al., 2006; Matsunaga, 2010; Valentine et al., 2015). Whilst the result for the second teamwork factor was 0.697, a similar α result for another factor has been identified and reported in a previous study (Hutchinson et al., 2006).

The optimal factor loadings for the final included items are presented in Table 5-4 and Table 5-5. These tables also indicate the items which were retained for the final factor structure.

Table 5-5 *Optimum factor loadings safety climate items*

Safety climate items	***Safety Climate Factor 1*** **Workplace safety culture**	***Safety Climate Factor 2*** **Leadership and error management**
15. The levels of staffing where I work are sufficient to handle the number of patients	.896	
16. I would feel safe being treated as a patient in this service	.865	
17. I am encouraged by my colleagues to report any patient safety concerns I may have	.457	.354
19. The culture where I work makes it easy to learn from the errors of others	.455	.340
20. I receive appropriate feedback about my performance	.380	.553
21. Medical errors are handled appropriately here		.808
22. I know the proper channels to which I should direct questions regarding patient safety		.601
24. Management does not knowingly compromise the safety of patients		.724
25. This organisation is doing more for patient safety than it did one year ago		.661
26. Leadership is driving us to be a safety-centred organisation		.814
27. My suggestions about safety would be acted upon if I expressed them to management		.802

Further non-retention of items may have improved the Cronbach's α result (refer to Appendix 12). However, decisions regarding which items to retain were also made in reference to the previous use of the questionnaire in the UK (Hutchinson et al., 2006). Therefore, the final factor structure for this research retained a similar number of items. This allowed for comparison of results to occur.

The final factor structure saw the original questionnaire reduced to 22 items which included two factors for teamwork and two for safety climate (11 items each). The items included in each were considered and the factors named to reflect these.

The first teamwork factor was labelled *teamwork and patient safety at bedside* and the second *workplace relationships and communication.* The safety climate factors were labelled *workplace safety culture* and *leadership and error management.*

With the factor structure and items to be included finalised it was then possible to calculate the factor scores for each respondent. This was done using the formula outlined in the previous chapter (Section 4.2.2).

The number of respondents with a positive score for each of the factors is presented in *Figure 5-12*. The teamwork factor *workplace relationships and communication* was the factor with the highest number of positive scores (79.6%, N=74). This was followed by the second teamwork factor *teamwork and patient safety at bedside* where 75.3% (N=70) of respondents had a positive factor score. The two safety climate factors of *leadership and error management* and *workplace safety culture* had 73.1% (N= 76) and 66.3% (N=69) of respondents with a positive score respectively.

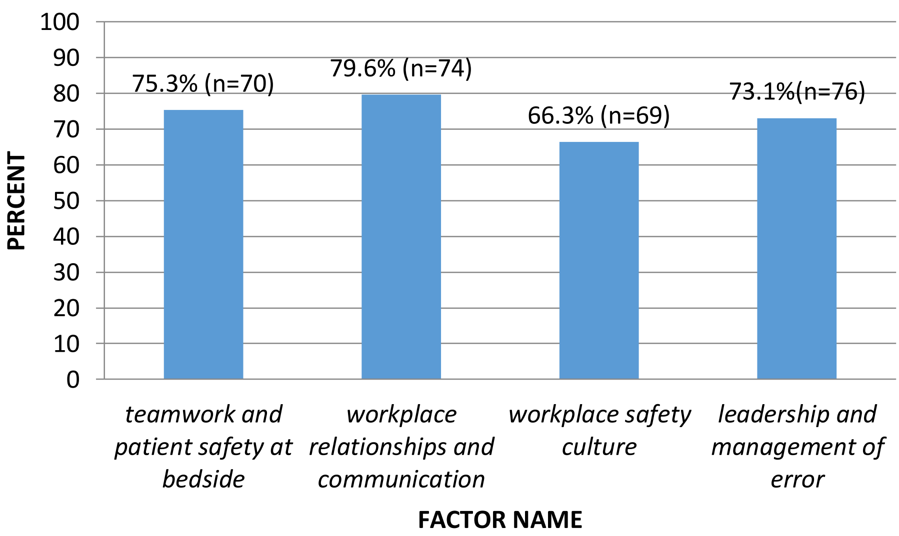

Figure 5-12: Percentage of positive factor scores (*teamwork N=94, safety climate N=103*)

Frequency data in relation to factor scores and views of reporting and disclosure were then subjected to further analysis. Inferential statistics were used to determine if areas differed in relation to the demographic data collected. These results will now be considered, with views of reporting and disclosure presented first.

5.7 The level of reporting and disclosure that nurses think is occurring

This section presents results relating to the first research sub-question which is: *what level of reporting and disclosure of different severity of a hypothetical medication error do nurses in rural clinical settings think is occurring?* Results were produced through the use of Chi-squared analysis incorporating the use of Fisher's Exact Test.

Following analysis utilising the abovementioned inferential statistics several differences were noted in regard to views of reporting and acknowledgment of error. Differences were found in relation to workplace setting and work role. These are in addition to those noted in Section 5.4relating to reporting and disclosure and severity of harm. The other area of difference noted was employment sector however these results may have been influenced by other factors such as workplace setting.

5.7.1 Differences amongst workplace settings

The views of error *Always* being reported are presented in Figure 14. Differences in the views of reporting an error were present in different workplace settings. The settings considered were hospital/multi-purpose settings, community and residential aged care. Due to a low number of responses from other areas these responses were excluded from the analysis. Further details of this can be found in the previous chapter (Section 4.4).

Amongst the nurses working in residential aged care settings, 96% (n=24) indicated a view that the severe error would *Always* be reported. This compared with 77.2% (n=44) amongst nurses in hospital/multi-purpose settings and 70.8% (n=17) amongst nurses in community settings.

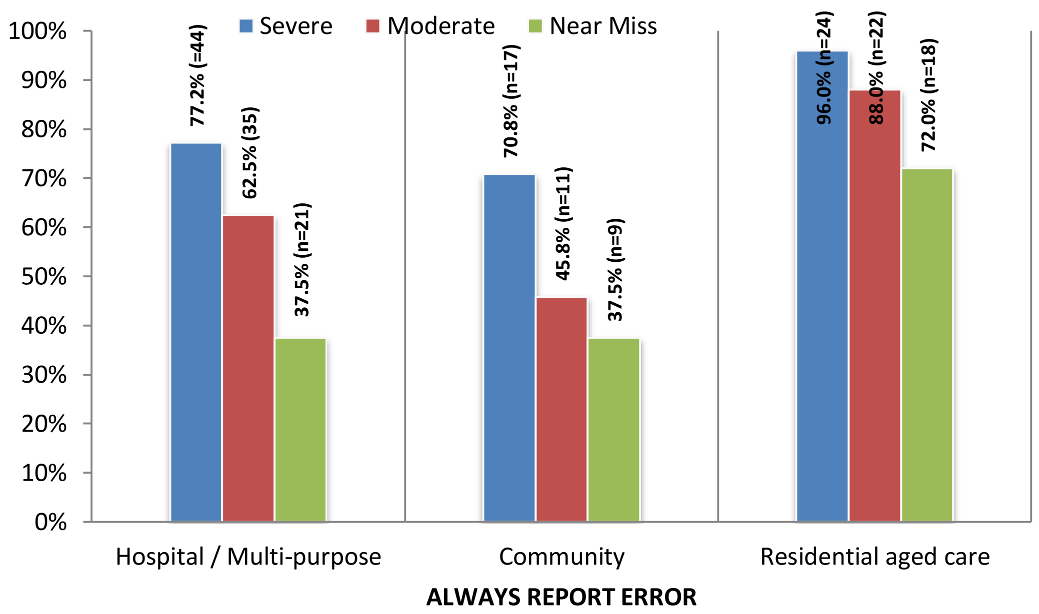

Figure 5-13: View that error 'Always' reported by workplace setting

It is not clear as to whether or not there is a difference amongst the different settings with regard to the frequency of views that a severe error would *Always* be reported. Whilst there seems to be a visible difference between the different settings as indicated in Figure 5-13 the results presented in Table 5-6 show the Pearson's χ^2 (p=0.061) for views that a severe error would *Always* be reported suggests that there is no significance with these results. However, the Fisher's Exact Test (p=0.042) suggests that there may be. As discussed in the previous chapter

(Section 4.4), in the event Chi-squared tables have cell counts less than five then the Fisher's Exact Test is recognised as a valid test alternative test (Howell, 2007).

Table 5-6 *Chi-squared test of the relationship between views of reporting severe error and workplace setting*

Formally report severe error		Workplace setting: Hospital/ Multi-purpose	Community	Residential aged care	Total
Always	Count	44	17	24	85
	% Workplace setting	77.2%	70.8%	96.0%	80.2%
	% of Total	41.5%	16.0%	22.6%	80.2%
Not Always	Count	13	7	1	21
	% Workplace setting	22.8%	29.2%	4.0%	19.8%
	% of Total	12.3%	6.6%	0.9%	19.8%
Total	Count	57	24	25	106
	% Workplace setting	100.0%	100.0%	100.0%	100.0%
	% of Total	53.8%	22.6%	23.6%	100.0%

$\chi^2 = 5.578^a$, df=2, N=106, p=0.061, Fisher's Exact = 0.042
a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 4.75

Results indicating differences between views that moderate or near miss error would *Always* be reported are clearer. In both cases none of the cells of the Chi-squared table have counts of less than five.

The results with respect to views of reporting the moderate error scenario presented in Table 5-7, note differences amongst the settings (p=0.007). There were 88% (n=22) of nurses in residential aged care indicating such an error would always be reported, compared with 62.5% (n=35) of nurses working in hospital/multi-purpose settings and 45.8% (n=11) of nurses in community settings.

Table 5-7 *Chi-squared test of the relationship between views of reporting moderate error and workplace setting*

Formally report moderate error		Workplace setting: Hospital/ Multi-purpose	Community	Residential aged care	Total
Always	Count	35	11	22	68
	% Workplace setting	62.5%	45.8%	88.0%	64.8%
	% of Total	33.3%	10.5%	21.0%	64.8%
Not Always	Count	21	13	3	37
	% Workplace setting	37.5%	54.2%	12.0%	35.2%
	% of Total	20.0%	12.4%	2.9%	35.2%
Total	Count	56	24	25	105
	% Workplace setting	100.0%	100.0%	100.0%	100.0%
	% of Total	53.3%	22.9%	23.8%	100.0%

χ^2= 9.809[a], df= 2, N=105, p=0.007, Fishers Exact=0.006
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 8.46.

Results presented in Table 5-8 suggest that the near miss scenario was also more likely to be viewed as *Always* reported. Amongst nurses in residential aged care settings (p=0.010) 72% (n=18) indicated this scenario would *Always* be reported whilst 37.5% (n=9) of nurses working in both hospital/multi-purpose and community settings indicated that outcome.

Table 5-8 *Chi-squared test of the relationship between views of reporting moderate error and work location/setting*

Formally report near miss error		Workplace setting: Hospital/ Multi-purpose	Community	Residential aged care	Total
Always	Count	21	9	18	48
	% Workplace setting	37.5%	37.5%	72.0%	45.7%
	% of Total	20.0%	8.6%	17.1%	45.7%
Not Always	Count	35	15	7	57
	% Workplace setting	62.5%	62.5%	28.0%	54.3%
	% of Total	33.3%	14.3%	6.7%	54.3%
Total	Count	56	24	25	105
	% Workplace setting	100.0%	100.0%	100.0%	100.0%
	% of Total	53.3%	22.9%	23.8%	100.0%

χ^2=9.136[a], df=2, N=105, p=0.010, Fishers Exact=0.011
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 10.97.

Figure 5-14: View error 'Always' be acknowledged by workplace setting

Differences in relation to views that each of the severe, moderate and near miss error scenarios would always be acknowledged were also noted across the workplace settings. Figure 5-14 presents the frequency of the view that such an error would *Always* be acknowledged to the patient/client or their family.

Table 5-9 *Chi squared test of the relationship between views of disclosure of severe error and workplace setting*

Acknowledge severe error to patient/client or family		Workplace setting: Hospital/ Multi-purpose	Community	Residential aged care	Total
Always	Count	28	8	22	58
	% within Workplace setting	49.1%	33.3%	88.0%	54.7%
	% of Total	26.4%	7.5%	20.8%	54.7%
Not Always	Count	29	16	3	48
	% within Workplace setting	50.9%	66.7%	12.0%	45.3%
	% of Total	27.4%	15.1%	2.8%	45.3%
Total	Count	57	24	25	106
	% within Workplace setting	100.0%	100.0%	100.0%	100.0%
	% of Total	53.8%	22.6%	23.6%	100.0%

χ^2=16.326[a]. df=2, N=106, p=0.000, Fisher's Exact=0.000
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 10.87.

Table 5-9 presents the difference amongst the workplace settings regarding the view that a severe error would *Always* be disclosed (χ^2=16.326 df=2, N=106, p=0.000). Nurses working in the residential aged care settings were more likely to indicate that a severe error would *Always* be disclosed with 88% (n=22) indicating this outcome compared to 49.1% (n=28) of nurses in hospital/multi-purpose settings and 33.3% (n=8) of nurses working in the community. None of the cells in this analysis had an expected count of less than five.

The views of the moderate scenario *Always* being reported indicated a similar difference across the settings (χ^2=22.319[a], df=2, N=105, p=0.000). Table 5-10 indicates 84% (n=21) of nurses in residential aged care settings were in agreement with this outcome. Once again nurses in hospital/multi-purpose settings were less likely to view the moderate scenario would *Always* be reported (37.5%, n=21) and community nurses even less likely again with 20.8% (n=5) indicating this outcome.

Table 5-10 Chi-squared test of the relationship between views of disclosure of moderate error and work location/setting

Acknowledge moderate error to patient/client or family		Workplace setting: Hospital/ Multi-purpose	Community	Residential aged care	Total
Always	Count	21	5	21	47
	% Workplace setting	37.5%	20.8%	84.0%	44.8%
	% of Total	20.0%	4.8%	20.0%	44.8%
Not Always	Count	35	19	4	58
	% Workplace setting	62.5%	79.2%	16.0%	55.2%
	% of Total	33.3%	18.1%	3.8%	55.2%
Total	Count	56	24	25	105
	% Workplace setting	100.0%	100.0%	100.0%	100.0%
	% of Total	53.3%	22.9%	23.8%	100.0%

χ^2=22.319[a], *df=2, N=105, p=0.000, Fisher's Exact=0.000*
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 10.74.

The scenario for near miss error being *Always* disclosed was also different across the settings (χ^2=29.127[a], df=2, N=106, p=0.000). Of the nurses in residential aged care settings 68% (n=17) agreed that this scenario would *Always* be disclosed. This view was much lower amongst nurses in both hospital/multi-purpose and community settings with just 14% (n=8) and 12.5% (n=3) respectively indicating this outcome. In the case of both moderate and near miss scenarios none of the cells had an expected count of less than five (refer to Table 5-11).

Table 5-11 *Chi-squared test of the relationship between views of disclosure of near miss error and work location/setting*

Acknowledge near miss error to patient/client or family		Workplace setting: Hospital/ Multi-purpose	Community	Residential aged care	Total
Always	Count	8	3	17	28
	% Workplace setting	14.0%	12.5%	68.0%	26.4%
	% of Total	7.5%	2.8%	16.0%	26.4%
Not Always	Count	49	21	8	78
	% Workplace setting	86.0%	87.5%	32.0%	73.6%
	% of Total	46.2%	19.8%	7.5%	73.6%
Total	Count	57	24	25	106
	% Workplace setting	100.0%	100.0%	100.0%	100.0%
	% of Total	53.8%	22.6%	23.6%	100.0%

χ^2=29.127[a], df=2, N=106, p=0.000, Fishers Exact=0.000
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.34.

Workplace setting was the only instance where differences in both views of error reporting and views of error disclosure were noted. However, analysis of other demographic conditions suggests differences may exist in relation to views of disclosure and work role as well as the employment sector of the nurse.

The frequency of a view that each of the scenarios would be acknowledged to the patient/client or their family depending upon work role are presented in *Figure 5-15*. The differences exist in respect to severe (χ^2=5.061[b], df=1, N=114, p=0.024[b], Phi=-0.233), moderate (χ^2=5.463[b], df=1, N=112, p=0.019[b], Phi=-0.243) and near miss (χ^2=7.140[b], df=1, N=114, p=0.008, Phi=-0.276) scenarios.

5.7.2 Differences in relation to work role

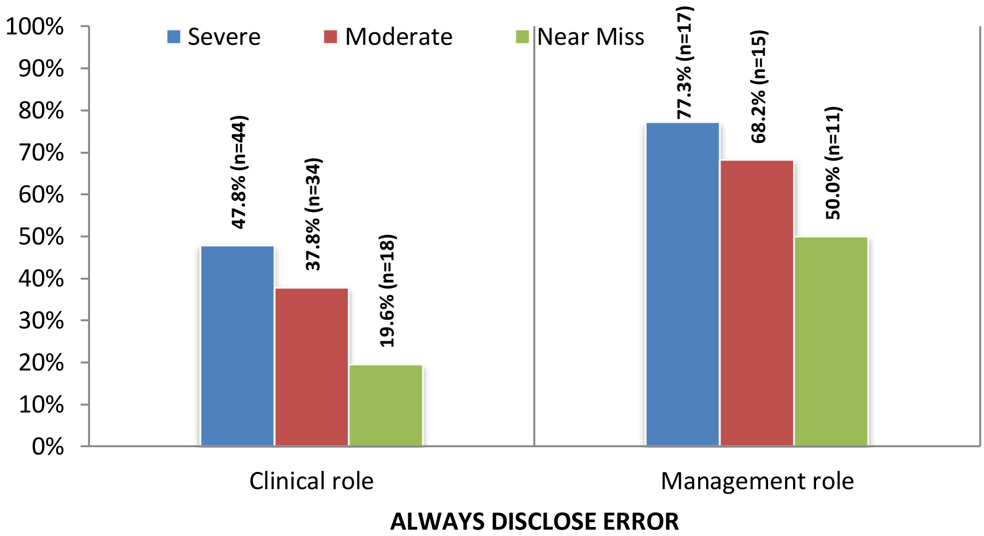

Figure 5-15: View that error would *Always* be disclosed by workplace role

Table 5-12 indicates that managers were more likely to indicate a view that a severe error would *Always* be disclosed, with 77.3% (n=17) indicating this outcome. The nurses working in a clinical role were less likely to indicate this response with less than half (47.8%, n=44) indicating this outcome. None of the cells in this analysis had an expected count of less than five.

Table 5-12 *Chi-squared test of the relationship between views of disclosure of severe error and work role*

Acknowledge severe error to patient/client or family		Workplace role: Clinical role	Workplace role: Management role	Total
Always	Count	44	17	61
	% Workplace role	47.8%	77.3%	53.5%
	% of Total	38.6%	14.9%	53.5%
Not Always	Count	48	5	53
	% Workplace role	52.2%	22.7%	46.5%
	% of Total	42.1%	4.4%	46.5%
Total	Count	92	22	114
	% Workplace role	100.0%	100.0%	100.0%
	% of Total	80.7%	19.3%	100.0%

χ^2=5.061[b], df=1, N=114, p=0.024[b], Phi=-0.233, Fisher's Exact=0.017
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 10.23
b. Computed only for a 2x2 table

Results from Table 5-13 show that whilst the overall response of a view that a moderate error would *Always* be reported was 43.8%, the clinical nurses were less likely to indicate this (37.8% n=34). Those working in a management role were more likely to view that the error to be disclosed with 68.2% (n=15) indicating this response.

Table 5-13 *Chi-squared test of the relationship between views of disclosure of moderate error and work role*

Acknowledge moderate error to patient/client or family		Workplace role: Clinical role	Workplace role: Management role	Total
Always	Count	34	15	49
	% Workplace role	37.8%	68.2%	43.8%
	% of Total	30.4%	13.4%	43.8%
Not Always	Count	56	7	63
	% Workplace role	62.2%	31.8%	56.2%
	% of Total	50.0%	6.2%	56.2%
Total	Count	90	22	112
	% Workplace role	100.0%	100.0%	100.0%
	% of Total	80.4%	19.6%	100.0%

χ^2=5.463[b], df=1, N=112, p=0.019[b], Phi=-0.243, Fisher's Exact=0.015
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 9.63.
b. Computed only for a 2x2 table

With regard to the near miss scenario, Table 5-14 shows that approximately one quarter of respondents indicated a view that the scenario would *Always* be disclosed in their workplace. However, just 19.6% (n=18) of nurses in a clinical role indicated this response compared with 50% (n=11) of nurses in a management role.

Table 5-14 *Chi-squared test of the relationship between views of disclosure of severe error and work role*

Acknowledge near miss error to patient/client or family		Workplace role: Clinical role	Workplace role: Management role	Total
Always	Count	18	11	29
	% Workplace role	19.6%	50.0%	25.4%
	% of Total	15.8%	9.6%	25.4%
Not Always	Count	74	11	85
	% Workplace role	80.4%	50.0%	74.6%
	% of Total	64.9%	9.6%	74.6%
Total	Count	92	22	114
	% Workplace role	100.0%	100.0%	100.0%
	% of Total	80.7%	19.3%	100.0%

χ^2=7.140[b], df=1, N=114, p=0.008, Phi=-0.276, Fisher's Exact=0.006
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.60.
b. Computed only for a 2x2 table

Having found differences in views of reporting and disclosure in different workplace settings and nurses working in different roles, consideration was given as to whether results in one of these may have influenced the other. Examination of the data indicated there was a higher than expected number of responses from managers working in aged care settings.

In order to determine if this had an impact on the results the analyses were redone with responses from nurses in management roles excluded. If having been found more likely to view errors disclosed, then the expected result after excluding these responses from further analyses the expected result would be either no significance in the result. This was not the case. The analysis of the views of clinicians only resulted in aged care nurses more likely to view error reported or disclosed across all levels of harm except the reporting of severe error.

5.7.3 Differences amongst clinicians

Closer examination of frequency data identified a greater frequency of managers who responded to the questionnaire occurred in aged care settings (refer to Appendix 8). It was possible that this may have influenced the results for Table 5-13 to Table 5-15.

Further analysis was therefore undertaken with only clinical respondents included in the sample. These results appear in Table 5-15 to Table 5-20.

Table 5-15 *Chi-squared test of the relationship between views of reporting severe error and workplace setting (clinical respondents only)*

Formally report severe error (clinical respondents only)		Workplace setting			Total
		Hospital/ Multi-purpose	Community	Residential aged care	
Always	Count	34	17	14	65
	% Workplace setting	72.3%	73.9%	100.0%	77.4%
	% of Total	40.5%	20.2%	16.7%	77.4%
Not Always	Count	13	6	0	19
	% Workplace setting	27.7%	26.1%	0.0%	22.6%
	% of Total	15.5%	7.1%	0.0%	22.6%
Total	Count	47	23	14	84
	% Workplace setting	100.0%	100.0%	100.0%	100.0%
	% of Total	56.0%	27.4%	16.7%	100.0%

χ^2=4.933[a], df=2, N=84, p=0.098, Fishers Exact=0.064
a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 3.17

Table 5-16 shows there was no statistical significance were found from respondents in relation to different workplace settings (χ^2*=4.933[a], df=2, N=84, p=0.098, Fishers Exact=0.064*). Of note, however, is that 100% of the respondents in aged care settings (n=14) held the view the severe error scenario would *Always* be reported in their workplace (Table 5-15). It is therefore possible that in this instance the higher response from nurses in management roles impacted these results.

Table 5-16 *Chi-squared test of the relationship between views of moderate error and workplace setting (clinical respondents only)*

Formally report moderate error (clinical respondents only)		Workplace setting			
		Hospital/ Multi-purpose	Community	Residential aged care	Total
Always	Count	27	11	14	52
	% within Workplace setting	58.7%	47.8%	100.0%	62.7%
	% of Total	32.5%	13.3%	16.9%	62.7%
Not Always	Count	19	12	0	31
	% within Workplace setting	41.3%	52.2%	0.0%	37.3%
	% of Total	22.9%	14.5%	0.0%	37.3%
Total	Count	46	23	14	83
	% within Workplace setting	100.0%	100.0%	100.0%	100.0%
	% of Total	55.4%	27.7%	16.9%	100.0%

χ^2=10.814[a], df=2, N=83, p=0.004, Fisher's Exact=0.002
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.23.

This was also the case with regards to the views relating to moderate error (Table 5-16) with 100% of nurses in aged care settings viewing this outcome as *Always reported* compared to nurses in hospital/multi-purpose settings (58.7%, n=27) and community settings (47.8%, n=11). However in this situation a statistical significance in the difference was found (χ^2*=10.814[a], df=2, N=83, p=0.004, Fisher's Exact=0.002).*

Thus, overall, whilst nurses in management roles were more likely to view moderate error reported compared to those in clinical roles, when removed from the sample 100% of the clinicians in aged care felt such an error would be reported in their workplace. This suggests that nurses in management roles did not impact these results through increased likelihood that the view would be reported.

Table 5-17 *Chi-squared test of the relationship between views of reporting near miss error and workplace setting (clinical respondents only)*

Formally report near miss error (clinical respondents only)		Workplace setting: Hospital/ Multi-purpose	Community	Residential aged care	Total
Always	Count	15	9	12	36
	% within Workplace setting	32.6%	39.1%	85.7%	43.4%
	% of Total	18.1%	10.8%	14.5%	43.4%
Not Always	Count	31	14	2	47
	% within Workplace setting	67.4%	60.9%	14.3%	56.6%
	% of Total	37.3%	16.9%	2.4%	56.6%
Total	Count	46	23	14	83
	% within Workplace setting	100.0%	100.0%	100.0%	100.0%
	% of Total	55.4%	27.7%	16.9%	100.0%

χ^2=12.558[a], df=2, N=83, p=0.002, Fishers exact =0.002
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.07.

Similarly with respect to near miss error (Table 5-17) those respondents in aged care settings (85.7%, n=12) were more likely to view the error would *Always* be reported compared to nurses in hospital/multipurpose (32.6%, n=15) or community (39.1%, n=9) settings (χ2=12.558[a], df=2, N=83, p=0.002, Fishers exact =0.002).

Therefore, in relation to views of error reporting it is possible that the results for the severe error scenario were influenced by the number of managers who responded in aged care. However, in the other error outcomes no influence was found that altered the results.

Table 5-18 *Chi-squared test of the relationship between views of disclosure of severe error and workplace setting (clinical respondents only)*

Acknowledge severe error to patient/client or family (clinical respondents only)		Workplace setting: Hospital/ Multi-purpose	Community	Residential aged care	Total
Always	Count	20	8	12	40
	% within Workplace setting	42.6%	34.8%	85.7%	47.6%
	% of Total	23.8%	9.5%	14.3%	47.6%
Not Always	Count	27	15	2	44
	% within Workplace setting	57.4%	65.2%	14.3%	52.4%
	% of Total	32.1%	17.9%	2.4%	52.4%
Total	Count	47	23	14	84
	% within Workplace setting	100.0%	100.0%	100.0%	100.0%
	% of Total	56.0%	27.4%	16.7%	100.0%

χ^2=10.148[a], df=2, N=84, p=0.005, Fisher's Exact=0.005
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.67.

By contrast, statistical significance was still found for differences in all the error scenarios relating to views of disclosure. Nurses in aged care settings (85.7%, n=12) were more likely to view the severe error *Always* reported) compared to those in hospital/multi-purpose (42.6, n=20) or community (34.8%, n=8) settings (χ^2*=10.148[a], df=2, N=84, p=0.005, Fisher's Exact=0.005*) (Table 5-19).

Table 5-19 *Chi-squared test of the relationship between views of disclosure of moderate error and workplace setting (clinical respondents only)*

Acknowledge moderate error to patient/client or family (clinical respondents only)		Workplace setting: Hospital/ Multi-purpose	Community	Residential aged care	Total
Always	Count	14	5	12	31
	% within Workplace setting	30.4%	21.7%	85.7%	37.3%
	% of Total	16.9%	6.0%	14.5%	37.3%
Not Always	Count	32	18	2	52
	% within Workplace setting	69.6%	78.3%	14.3%	62.7%
	% of Total	38.6%	21.7%	2.4%	62.7%
Total	Count	46	23	14	83
	% within Workplace setting	100.0%	100.0%	100.0%	100.0%
	% of Total	55.4%	27.7%	16.9%	100.0%

χ^2=17.330[a], df=2, N=83, p=0.000, Fisher's Exact=0.000
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.23.

As indicated in Table 5-19, 85.7% (n=12) of nurses in aged care settings viewed the moderate error scenario would *Always* be acknowledged in their workplace

(χ^2=17.330[a], df=2, N=83, p=0.000, Fisher's Exact=0.000). Nurses in community settings (21.7%, n=5) and in rural hospital/multi-purpose settings (30.4%, n=14) were less likely to view this scenario would *Always* be disclosed.

Table 5-20 *Chi-squared test of the relationship between views of disclosure of near miss error and workplace setting (clinical respondents only)*

Acknowledge near miss error to patient/client or family (clinical respondents only)		Workplace setting			
		Hospital/ Multi-purpose	Community	Residential aged care	Total
Always	Count	3	3	10	16
	% within Workplace setting	6.4%	13.0%	71.4%	19.0%
	% of Total	3.6%	3.6%	11.9%	19.0%
Not Always	Count	44	20	4	68
	% within Workplace setting	93.6%	87.0%	28.6%	81.0%
	% of Total	52.4%	23.8%	4.8%	81.0%
Total	Count	47	23	14	84
	% within Workplace setting	100.0%	100.0%	100.0%	100.0%
	% of Total	56.0%	27.4%	16.7%	100.0%

χ^2=30.338[a], df=2, N=84, p=0.000, Fisher's Exact=0.000

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 2.67.

Results relating to the disclosure of near miss error are of concern (refer to Table 5-20). Only 6.4% (n=3) of the nurses in the rural hospital/multi-purpose and 13.0% (n=3) in community settings felt this scenario would *Always* be disclosed. This compares to 71.4% (n=10) of the nurses in aged care settings (χ^2=30.338[a], df=2, N=84, p=0.000, Fisher's Exact=0.000).

The analyses conducted with the respondents in management roles excluded had a two-fold impact. Firstly, the number of respondents indicating they felt the error would *Always* be reported or disclosed increased. Secondly there was no significance found for the results regarding the view of reporting the severe error.

5.7.4 Differences in relation to employment sector

When considering employment sector, there was no statistical significance found with respect to views of reporting error. Nor was there any statistical significance in relation to views of disclosure of severe error. However, the results in relation to views of disclosure of moderate and near miss error indicated possible difference amongst employment sector.

Table 5-21 *Chi-squared test of the relationship between views of disclosure of moderate error and employment sector*

Acknowledge moderate error to patient/client or family		Employment sector: Government (DHHS)	Employment sector: Non-Government/ private sector	Total
Always	Count	28	22	50
	% employment sector	37.8%	59.5%	45.0%
	% of Total	25.2%	19.8%	45.0%
Not Always	Count	46	15	61
	% employment sector	62.2%	40.5%	55.0%
	% of Total	41.4%	13.5%	55.0%
Total	Count	74	37	111
	% employment sector	100.0%	100.0%	100.0%
	% of Total	66.7%	33.3%	100.0%

χ^2=3.826[b], df=1, N=111, p=0.050[b], Phi=-0.205, Fisher's Exact=0.043
a. 0 cells (0%) have expected count less than 5. The minimum expected count is 16.67
b. Computed only for a 2x2 table

Results for views of disclosure of the moderate error scenario are outlined in Table 5-21. The respondents in the non-government/private sector were more likely to view an error would be disclosed (59.5%, n=22) compared to those working in the government sector (37.8%, n=28). However, these data need to be interpreted with caution as whilst the Fisher's Exact is p=0.043 the Yates Continuity Correction does not indicate statistical significance in this result (χ^2=3.826[b], df=1, N=111 p=0.05). The Pearson's χ^2 is 4.658 (p=0.043) and with no cells having an expected count of less than 5, the results are therefore not conclusive.

The near miss error scenario indicates clearer results. These are presented in Table 5-22. Of nurses employed in the non-government/private sector 47.4% (n=18) indicated that this scenario outcome would be disclosed in their workplace. This compares with 16% (n=12) of those employed in the government sector.

Table 5-22 *Chi-squared test of the relationship between views of disclosure of near miss error and employment sector*

Acknowledge near miss error to patient/client or family		Employment sector: Government (DHHS)	Employment sector: Non-Government/ private sector	Total
Always	Count	12	18	30
	% employment sector	16.0%	47.4%	26.5%
	% of Total	10.6%	15.9%	26.5%
Not Always	Count	63	20	83
	% employment sector	84.0%	52.6%	73.5%
	% of Total	55.8%	17.7%	73.5%
Total	Count	75	38	113
	% employment sector	100.0%	100.0%	100.0%
	% of Total	66.4%	33.6%	100.0%

χ^2=11.169[b], df=1, N=113, p=0.001[b], Phi=-0.336, Fisher's Exact=0.001
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 10.09
b. Computed only for a 2x2 table

It is possible that workplace settings may have influenced this result. Nurses in residential aged care settings are predominantly based in the non-government/private sector. Nurses employed by government Department of Health and Human Services (DHHS) are predominantly employed in hospital/multi-purpose and community settings.

Table 5-23 *Chi-squared test of the relationship between views of disclosure of moderate error and employment sector (aged care respondents excluded)*

Acknowledge moderate error to patient/client or family (aged care respondents excluded)		Employment Sector Government (DHHS)	Non-Government/ private sector	Total
Always	Count	26	3	29
	% employment sector	36.1%	21.4%	33.7%
	% of Total	30.2%	3.5%	33.7%
Not Always	Count	46	11	57
	% employment sector	63.9%	78.6%	66.3%
	% of Total	53.5%	12.8%	66.3%
Total	Count	72	14	86
	% employment sector	100.0%	100.0%	100.0%
	% of Total	83.7%	16.3%	100.0%

χ^2=0.569[b], df=1, N=86, p=0.366[b], Phi=0.115, Fisher's Exact=0.366
a.1 cells (25.0%) have expected count less than 5. The minimum expected count is 4.72
b. Computed only for a 2x2 table

Results were therefore analysed with responses from nurses indicating they worked in aged care excluded. The results of this additional analysis may be found in Table 5-23 and Table 5-24.

Table 5-24 *Chi-squared test of the relationship between views of disclosure of near miss error and employment sector (aged care respondents excluded)*

Acknowledge near miss error to patient/client or family (aged care respondents excluded)		Employment sector Government (DHHS)	Non-Government/ private sector	Total
Always	Count	11	2	13
	% employment sector	15.1%	13.3%	14.8%
	% of Total	12.5%	2.3%	14.8%
Not Always	Count	62	13	75
	% employment sector	84.9%	86.7%	85.2%
	% of Total	70.5%	14.8%	85.2%
Total	Count	73	15	88
	% employment sector	100.0%	100.0%	100.0%
	% of Total	83.0%	17.0%	100.0%

χ^2=0.000[b], df=1,N=88, p=1.000[b], Phi=.018, Fisher's Exact=1.000
a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 2.22.
b. Computed only for a 2x2 table

There was no statistical difference found between nurses working in the government and non-government employment sectors in relation to views of disclosure of either the moderate ($\chi^{2=}$*0.569*[b]*, df=1, N=86, p=0.366*[b]*, Phi=0.115, Fisher's Exact=0.366*) or near miss scenarios (*$\chi^{2=}$0.000*[b]*, df=1, N=88, p=1.000*[b]*, Phi=.018, Fisher's Exact=1.000).*

The results presented in this section inform the first research question of this research which is: *what level of reporting and disclosure of different severity of a hypothetical medication error do nurses in rural clinical settings think is occurring?* Differences have been observed in relation to workplace setting and work role. Other differences may have been influenced by the nature of the sample obtained. Such influences reflect the complexity of views of reporting and disclosure that were outlined in the literature review (Sections 2.10 to 2.14).

These issues will be discussed in more detail in the following chapter. The results relating to safety climate will now be considered.

5.8 The nature of safety climate amongst nurses in rural clinical settings

In addition to views of reporting and disclosure, data were also analysed in relation to safety climate and teamwork factors extracted through PCA and demographic data. This analysis noted differences in some factors being positive across workplace setting, facility bed numbers, workplace role and geographical location. These results inform the second research sub-question which is: *what is the nature of workplace safety climate amongst nurses in these settings?*

5.8.1 Differences in relation to workplace setting

In the different workplace settings nurses in residential aged care (83.3%, n=20) and community settings (81.8%, n=18) were more likely to have a positive score in relation to *workplace safety culture* (χ^2= 9.194[a], df=2, N=98, p=0.010, Fisher's Exact

Test p=0.012) compared to those in a hospital/multi-purpose setting (53.8%, n=28). These results are outlined in Table 5-25.

Table 5-25 *Chi Squared test of workplace safety culture and work location/facility setting*

Workplace safety culture		Workplace setting			Total
		Hospital/ Multi-purpose	Community	Residential aged care	
Positive	Count	28	18	20	66
	% Workplace setting	53.8%	81.8%	83.3%	67.3%
	% of Total	28.6%	18.4%	20.4%	67.3%
Not positive	Count	24	4	4	32
	% Workplace setting	46.2%	18.2%	16.7%	32.7%
	% of Total	24.5%	4.1%	4.1%	32.7%
Total	Count	52	22	24	98
	% Workplace setting	100.0%	100.0%	100.0%	100.0%
	% of Total	53.1%	22.4%	24.5%	100.0%

χ^2= 9.194[a], df=2, N=98, p=0.010, Fisher's Exact Test p=0.012
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.18.

5.8.2 Differences relating to facility size

Results from Table 5-26, which presents the results of positive scores for the *workplace safety culture* factor in relation to facility bed numbers, need to be interpreted with caution. Whilst the χ^2 result (8.012[a], df=3, N=100, p=0.048) was significant, one cell had an expected count of less than fie and the Fisher's Exact Test (p=0.05) suggests that this result may be questionable. The overall rate of positive scores in this factor was 68% (n=68). Nurses in facilities of less than 50 beds had a higher rate of positive score (76.2% n=32) as did those indicating *Other/not applicable* (83.3%, n=15).

Table 5-26 *Chi-squared of workplace safety culture of error and facility bed numbers*

Workplace safety culture		Facility bed numbers: less than 50 beds	50 - 99 beds	100+ beds	Other/not applicable	Total
Positive	Count	32	15	6	15	68
	% facility bed numbers	76.2%	55.6%	46.2%	83.3%	68.0%
	% of Total	32.0%	15.0%	6.0%	15.0%	68.0%
Not positive	Count	10	12	7	3	32
	% facility bed numbers	23.8%	44.4%	53.8%	16.7%	32.0%
	% of Total	10.0%	12.0%	7.0%	3.0%	32.0%
Total	Count	42	27	13	18	100
	% facility bed numbers	100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total	42.0%	27.0%	13.0%	18.0%	100.0%

$\chi^2 = 8.012^a$, df=3, N=100, p=0.048, Fisher's Exact Test p = 0.05
a. 1 cells (12.5%) have expected count less than 5. The minimum expected count is 4.16.

Those in facilities with 50 or more beds were less likely to have a positive score for *workplace safety culture*. Of the nurses working in facilities of 100 or more beds 46.2% (n=6) had a positive score whilst amongst those working in facilities with 50 to 90 beds 55.6% (n=15) indicated a positive score.

Taking into consideration the possible impact of workplace setting upon the results relating to bed numbers, analysis was undertaken to determine whether the responses from nurses in aged care settings may have influenced this result. This analysis indicated that nurses working in rural hospital/multi-purpose settings were more likely to be working in facilities of less than 50 beds (refer to Appendix 8). As these nurses were less likely to have a positive factor score for *workplace safety culture* (Table 5-25) it is unlikely that workplace setting had any influence over these results.

It was also considered possible that responses from nurses in a management role may have impacted upon the results related to facility bed numbers. However, there was no significance in responses from managers when compared to bed numbers (refer to Appendix 8).

5.8.3 Differences relating to work role

The rate of positive factor scores also differed amongst those in a clinical or management role. All of the three factor scores for safety climate (*workplace safety culture, leadership and error management and overall safety climate factor score*) suggest differences in the positive scores amongst those in a clinical role and those in a management role. These results are presented in Table 5-27 to Table 5-29.

*Workplace relationships and communicatio*n was the only factor that did not exhibit a difference, although the results presented in Table 5-27 suggest caution when considering results in relation to differences in the factor of teamwork and patient safety at the bedside. Whilst Yates continuity correction ($\chi^2 = 3.737^b$, df=1 N=92, p=0.053[b], Phi=-0.233) does not suggests significance in the results, one cell had an expected count of less than five. The subsequent Fisher's Exact test (p=0.035) suggests the results are statistically significant.

With 75% (n=69) of the sample indicating a positive score for *teamwork and safety climate at the bedside*, 94.7% (n=18) of those in a management role indicated a positive score compared to 69.9% (n=51) of those in a clinical role.

Table 5-27 *Chi-squared test of teamwork and patient safety at bedside and work role*

Teamwork and patient safety at bedside		Work role: Clinical role	Work role: Management role	Total
Positive	Count	51	18	69
	% Workplace role	69.9%	94.7%	75.0%
	% of Total	55.4%	19.6%	75.0%
Not positive	Count	22	1	23
	% Workplace role	30.1%	5.3%	25.0%
	% of Total	23.9%	1.1%	25.0%
Total	Count	73	19	92
	% Workplace role	100.0%	100.0%	100.0%
	% of Total	79.3%	20.7%	100.0%

χ^2=3.737[b], df=1 N=92, p=0.053[b], Phi=-0.233, Fisher's Exact Test p=0.035

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 4.75.

b. Computed only for a 2x2 table

With regard to *workplace safety culture* the overall rate of positive scores was 66% (n=68) of the total responses. However, those in a management role were more likely to have a positive score with 88.9% (n=16) compared to 61.2% (n=52) amongst those in a clinical role. This difference (χ^2= 3.925[b], df=1 N=103, p=0.048[b], Phi=-0.222, Fisher's Exact Test p = 0.028) is presented in Table 5-28.

Table 5-28 *Chi-squared test of workplace safety culture and work role*

Workplace safety culture		Work role: Clinical role	Work role: Management role	Total
Positive	Count	52	16	68
	% Workplace role	61.2%	88.9%	66.0%
	% of Total	50.5%	15.5%	66.0%
Not positive	Count	33	2	35
	% Workplace role	38.8%	11.1%	34.0%
	% of Total	32.0%	1.9%	34.0%
Total	Count	85	18	103
	% Workplace role	100.0%	100.0%	100.0%
	% of Total	82.5%	17.5%	100.0%

χ^2= 3.925[b], df=1 N=103, p=0.048[b], Phi=-0.222, Fisher's Exact Test p = 0.028
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.12
b. Computed only for a 2x2 table

The scores for *leadership and error management* also differed between clinicians and managers (χ^2 = 6.564b, df=1, N=103, p=0.010[b], Phi=-0.281, Fisher's Exact Test p=0.003) as indicated in Table 5-29. All of the respondents in a management role (100%, n=18) had a positive score for this factor compared to 67.1% (n=17) of those in a clinical role. The overall total percentage of positive scores was 72.8% (n=75).

Table 5-29 *Chi-squared test of leadership and error management and workplace role*

Leadership and error management		Workplace role Clinical role	 Management role	Total
Positive	Count	57	18	75
	% Workplace role	67.1%	100.0%	72.8%
	% of Total	55.3%	17.5%	72.8%
Not positive	Count	28	0	28
	% Workplace role	32.9%	0.0%	27.2%
	% of Total	27.2%	0.0%	27.2%
Total	Count	85	18	103
	% Workplace role	100.0%	100.0%	100.0%
	% of Total	82.5%	17.5%	100.0%

$\chi^2 = 6.564^b$, df=1, N=103, p=0.010[b], Phi=-0.281, Fisher's Exact Test p=0.003
a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 4.89.
b. Computed only for a 2x2 table

5.8.4 Differences relating to geographical location

The results of safety climate and teamwork factors and geographical location were mixed. Whilst statistically significant, the low number of responses from workplaces in remote/very remote areas (ASGC-RA 4—5) saw a large number of cells with an expected count of less than five. Even reducing the variables to a 2x2 table resulted in only 4 total responses in the total for remote/very remote localities (refer to Appendix 11).

Data in relation to regions were more suitable for analysis. However, only the results for the factor of *workplace safety culture* indicated a statistical significance (χ^2= 6.598[a], df=2, N=103, p=0.037, Fisher's Exact Test p = 0.032) and these results are presented in Table 5-30. Whilst 67% (n=67) of total respondents had a positive score for this factor those in the northern region (85.2%, n=23) and southern region (70.6%, n=12) were more likely to have a positive score than those from the north-west region (57.1%, n=32).

Table 5-30 *Chi-squared of workplace safety culture and region*

Workplace safety culture		Region Sth	Nth	NW	Total
Positive	Count	12	23	32	67
	% Region	70.6%	85.2%	57.1%	67.0%
	% of Total	12.0%	23.0%	32.0%	67.0%
Not positive	Count	5	4	24	33
	% Region	29.4%	14.8%	42.9%	33.0%
	% of Total	5.0%	4.0%	24.0%	33.0%
Total	Count	17	27	56	100
	% Region	100.0%	100.0%	100.0%	100.0%
	% of Total	17.0%	27.0%	56.0%	100.0%

χ^2= 6.598[a], df=2, N=103, p=0.037, Fisher's Exact Test p = 0.032
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.61.

As with previous analyses it was considered whether other results may have influenced the results in relation to geographical region. Further analyses indicated that there was no significant difference in responses received based on workplace setting or work role in relation to geographical region. However, some differences were found in relation to bed numbers.

There were more facilities with between 50 –99 beds in the northern region where a higher factor score was noted. However, responses from the northwest region were also more likely to have a positive factor score despite not having more facilities with this number of beds.

The other possible area of influence in this regard was a higher number of respondents in the north-west region indicating they worked in facilities with 100 or more beds. However, the acute hospitals located in the north and south are located in ASGC-RA 2 locations and were therefore excluded from this research. This left the only acute hospitals with more than 100 beds located in the north-west. As those located in hospital settings were less likely to have a positive factor score, this may have influenced the results with respect to region. Therefore, these results should be interpreted bearing this in mind.

Having considered the results for each factor in conjunction with demographic information it is possible to summarise the areas of difference in teamwork and safety climate factor scores. In doing so it is possible to inform the second research sub-question of: *what is the nature of workplace safety climate amongst nurses in these settings?*

Nurses working in aged care and community settings were more likely to have a positive factor score for *workplace safety culture* compared to nurses working in hospital/multi-purpose settings. This is the only factor score where a difference was noted in relation to workplace setting.

Three factors were more likely to be positive amongst nurses working in a management role compared to those in a clinical role. These three factors were *teamwork and patient safety at bedside, workplace safety culture* and *leadership and error management.*

Just as there were some differences were found in relation to views of reporting, the results of this section found differences between safety climate and views of reporting and disclosure. These will also be discussed further in the following chapter.

5.9 The variable-based relationship between safety climate and views of reporting and disclosure

Having established the level of reporting that this sample of nurses in rural clinical settings think is being reported and the level of safety climate and teamwork factors, the relationship between the two will now be explored. Results presented in this section relate to the third research sub-question of the thesis which is: *What is the relationship between workplace safety climate amongst nurses in rural clinical settings and their views of reporting/disclosure of a hypothetical medication error?*

Once again chi-squared analysis was undertaken. The results appear in Table 5-31 to Table 5-39. The only area where statistical significance was noted in relation to views of reporting error were those associated with the views of reporting the severe error scenario. All scenarios relating to views of disclosure resulted in elements of teamwork and safety climate demonstrating differences.

In all the scenarios where the differences were statistically significant, *teamwork and patient safety at the bedside,* and *leadership and error management* were of influence. In relation to the disclosure of moderate error, workplace and safety culture was also statistically significant.

5.9.1 Differences relating to views of reporting error

Table 5-31 and Table 5-32 present the results with regard to the relationship between factor scores and views of reporting the severe error scenario. Table 5-31 shows that whilst 82.8% (n=77) of respondents had a view that the severe error scenario would *Always* be reported, 88.6% (n=62) of those with a positive score for the factor of *teamwork and safety at the bedside* indicated they thought the severe error scenario would *Always* be reported compared to only 65.2% (n=15) of respondents with a factor score that was not positive.

Table 5-31 *Chi-squared test of teamwork and patient safety at bedside and view of reporting severe error*

	Formally report severe error	Teamwork and patient safety at bedside: Positive	Teamwork and patient safety at bedside: Not positive	Total
Always	Count	62	15	77
	% Teamwork and patient safety at bedside	88.6%	65.2%	82.8%
	% of Total	66.7%	16.1%	82.8%
Not Always	Count	8	8	16
	% Teamwork and patient safety at bedside	11.4%	34.8%	17.2%
	% of Total	8.6%	8.6%	17.2%
Total	Count	70	23	93
	% Teamwork and patient safety at bedside	100.0%	100.0%	100.0%
	% of Total	75.3%	24.7%	100.0%

χ^2= 5.090[b], df=1, N=103, p=0.024[b], Phi=0.302, Fisher's Exact Test p = 0.022
a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 3.96.
b. Computed only for a 2x2 table

Table 5-32 shows the results in relation to safety climate. Of the 104 respondents included within this factor, 79.8% had a view that the severe scenario would *Always* be reported. However, amongst those with a positive factor score for *leadership and error management*, 86.8% (n=66) viewed this scenario would *Always* be reported and 60.7% (n=17) of those with a score that was not positive had the same view.

Table 5-32 *Chi-squared test of leadership and error management and view of reporting severe error*

Formally report severe error		Leadership and error management: Positive	Leadership and error management: Not positive	Total
Always	Count	66	17	83
	% Leadership and error management	86.8%	60.7%	79.8%
	% of Total	63.5%	16.3%	79.8%
Not Always	Count	10	11	21
	% Leadership and error management	13.2%	39.3%	20.2%
	% of Total	9.6%	10.6%	20.2%
Total	Count	76	28	104
	% Leadership and error management	100.0%	100.0%	100.0%
	% of Total	73.1%	26.9%	100.0%

$\chi^2 = 7.122^b$, df=1, N=104, p=0.008[b], Phi=0.289, Fisher's Exact Test p = 0.006
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.65
b. Computed only for a 2x2 table

5.9.2 Differences relating to views of disclosure of error

Views of the disclosure of severe error scenario and the various factor scores identified with statistical significance in the results appear in Table 5-33 and Table 5-34. Of the 93 respondents in the teamwork factors, 57% (n=53) of respondents indicated that the severe error scenario would *Always* be disclosed. There were 104 respondents included in the analysis of safety climate factors of whom 52.2% (n=55) indicated the severe error would be disclosed.

Table 5-33 *Chi-squared test of teamwork and patient safety at bedside and view of disclosure severe error*

Acknowledge severe error to patient/client or family		Teamwork and patient safety at bedside Positive	Not positive	Total
Always	Count	47	6	53
	% Teamwork and patient safety at bedside	67.1%	26.1%	57.0%
	% of Total	50.5%	6.5%	57.0%
Not Always	Count	23	17	40
	% Teamwork and patient safety at bedside	32.9%	73.9%	43.0%
	% of Total	24.7%	18.3%	43.0%
Total	Count	70	23	93
	% Teamwork and patient safety at bedside	100.0%	100.0%	100.0%
	% of Total	75.3%	24.7%	100.0%

$\chi^2 = 10.289^b$, df=1, N=93, p=0.001[b], Phi=0.358, Fisher's Exact Test p = 0.001
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 9.89.
b. Computed only for a 2x2 table

Results presented in Table 5-33 show whilst 57% of the respondents viewed the severe error would *Always* be disclosed, 67.1% (n=47) of those with a positive score for *teamwork and patient safety at the bedside* indicated such a view compared to just 26.1% (n=6) of those respondents with a factor score that was not positive.

Table 5-34 *Chi-squared test of leadership and error management and view of disclosure severe error*

Acknowledge severe error to patient/client or family		Leadership and error management Positive	Not positive	Total
Always	Count	48	7	55
	% Leadership and error management	63.2%	25.0%	52.9%
	% of Total	46.2%	6.7%	52.9%
Not Always	Count	28	21	49
	% Leadership and error management	36.8%	75.0%	47.1%
	% of Total	26.9%	20.2%	47.1%
Total	Count	76	28	104
	% Leadership and error management	100.0%	100.0%	100.0%
	% of Total	73.1%	26.9%	100.0%

$\chi^2 = 10.474^b$, df=1, N=104, p=0.001[b], Phi=0.339, Fisher's Exact Test p = 0.001
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 13.19
b. Computed only for a 2x2 table

Respondents with a positive factor score for leadership and error management were more likely to view the severe error would be disclosed, with 63.2% (n=48) indicating this outcome. Of those with a factor score that was not positive, 25% (n= 7) indicated they felt the severe error scenario would be acknowledged to the patient/client or family. These results can be seen in Table 5-34.

The results in Table 5-35 to Table 5-37 relate to the teamwork and safety climate factor scores and views of reporting the moderate error scenario. Of the 93 respondents included in the teamwork factor analysis, less than half (46.2%, n=43) indicated a view that this scenario would *Always* be acknowledged. There were 102 respondents included in the analysis relating to safety climate factors and again, less than half (41.2%, n= 42) indicated the same outcome.

Table 5-35 *Chi-squared test of teamwork and patient safety at bedside and view of disclosure moderate error*

Acknowledge moderate error to patient/client or family		Teamwork and patient safety at bedside		Total
		Positive	Not positive	
Always	Count	39	4	43
	% Teamwork and patient safety at bedside	55.7%	17.4%	46.2%
	% of Total	41.9%	4.3%	46.2%
Not Always	Count	31	19	50
	% Teamwork and patient safety at bedside	44.3%	82.6%	53.8%
	% of Total	33.3%	20.4%	53.8%
Total	Count	70	23	93
	% Teamwork and patient safety at bedside	100.0%	100.0%	100.0%
	% of Total	75.3%	24.7%	100.0%

χ^2 = 8.744[b], df=1, N=93, p=0.032[b], Phi=0.332, Fisher's Exact Test p = 0.002
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 10.63.
b. Computed only for a 2x2 table

However, a respondent with a positive factor score for teamwork and patient safety at the bedside was more likely to view the moderate error would be disclosed. Table 5-35 shows that 55.7% (n=39) of respondents viewed this outcome to be likely compared to just 17.4% (n=4) of those with a score that was not positive.

Results from Table 5-36 show that 49.3% (n=34) of respondents with a positive factor score for *workplace safety culture* viewed the moderate error scenario would *Always* be disclosed compared to 24.2% (n=8) of respondents with a factor score that was not positive. Of interest in this result is that whilst the positive factor score may have a higher probability of a view the error would *Always* be disclosed than the overall sample result of 41.2%, more than half of those with a positive factor score 50.7% (n=35) viewed the error would *Not always* be reported.

Table 5-36 *Chi-squared test of workplace safety climate and view of disclosure moderate error*

Acknowledge moderate error to patient/client or family		Workplace safety culture Positive	Not positive	Total
Always	Count	34	8	42
	% Workplace safety culture	49.3%	24.2%	41.2%
	% of Total	33.3%	7.8%	41.2%
Not Always	Count	35	25	60
	% Workplace safety culture	50.7%	75.8%	58.8%
	% of Total	34.3%	24.5%	58.8%
Total	Count	69	33	102
	% Workplace safety culture	100.0%	100.0%	100.0%
	% of Total	67.6%	32.4%	100.0%

χ^2 = 4.788[b], df=1, N=102, p=0.029[b], Phi=0.238, Fisher's Exact Test p = 0.019
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 13.59.
b. Computed only for a 2x2 table

Similar results are present in Table 5-37. Of the respondents with a positive score for the factor *leadership and error management* 49.3% (n=37) indicated they viewed the error would *Always* be disclosed compared to 18.5% (n=5) of those with a score that was not positive. Once again there were more than half the respondents (50.7%, n=38) who viewed such an error would *Always* be reported, despite the positive factor score.

Table 5-37 *Chi-squared Leadership and error management and view of disclosure moderate error*

Acknowledge moderate error to patient/client or family		Leadership and error management Positive	Not positive	Total
Always	Count	37	5	42
	% Leadership and error management	49.3%	18.5%	41.2%
	% of Total	36.3%	4.9%	41.2%
Not Always	Count	38	22	60
	% Leadership and error management	50.7%	81.5%	58.8%
	% of Total	37.3%	21.6%	58.8%
Total	Count	75	27	102
	% Leadership and error management	100.0%	100.0%	100.0%
	% of Total	73.5%	26.5%	100.0%

χ^2 = 6.563[b], df=1, N=102, p=0.004[b], Phi=0.276, Fisher's Exact Test p = 0.006
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 11.12.
b. Computed only for a 2x2 table

The results related to the teamwork and safety climate factor scores and views of the disclosure of near miss error are presented in Table 5-38 and Table 5-39. As was the case with views of reporting severe error, positive scores in relation to teamwork and patient safety at the bedside, overall teamwork, leadership and error management and overall safety climate resulted in a greater likelihood that the error scenario would be viewed as *Always* disclosed.

Of the 93 respondents included in the teamwork factor analysis, 26.9% (n=25) viewed the near miss scenario would *Always* be disclosed. There were 104 respondents included in the safety climate analysis of whom 25% (n=26) viewed the same outcome.

A positive score for *teamwork and patient safety at bedside* resulted in a greater likelihood that the error would *Always* be disclosed with 32.9% (n=23) of respondents indicating this outcome. This compares to 8.7% (n=2) of respondents who had a factor score that was 'not positive'. These results can be seen in Table 5-38.

Table 5-38 *Chi-squared test of teamwork and patient safety at bedside and view of disclosure near miss error*

Acknowledge near miss error to patient/client or family		Teamwork and patient safety at bedside Positive	Not positive	Total
Always	Count	23	2	25
	% Teamwork and patient safety at bedside	32.9%	8.7%	26.9%
	% of Total	24.7%	2.2%	26.9%
Not Always	Count	47	21	68
	% Teamwork and patient safety at bedside	67.1%	91.3%	73.1%
	% of Total	50.5%	22.6%	73.1%
Total	Count	70	23	93
	% Teamwork and patient safety at bedside	100.0%	100.0%	100.0%
	% of Total	75.3%	24.7%	100.0%

χ^2 = 3.986, df=1, N=93, p=0.046[b], Phi=0.235, Fisher's Exact Test p = 0.018
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.18.
b. Computed only for a 2x2 table

Table 5-39 shows that 30.3% of respondents with a positive score for *leadership and error management* indicated they viewed the near miss error would *Always* be disclosed. This compares to 10.7% (n=3) of respondents with a positive score for this factor who viewed the same outcome. Although there were no cells having an expected count of less than five the Yates continuity correction (p=0.074) is a p value >0.05 whilst the Fisher's Exact Test is p=0.045 indicating that the results from this table are inconclusive.

Table 5-39 *Chi-squared test of leadership and error management and view of disclosure near miss error*

Acknowledge near miss error to patient/client or family		Leadership and error management Positive	Not positive	Total
Always	Count	23	3	26
	% Leadership and error management	30.3%	10.7%	25.0%
	% of Total	22.1%	2.9%	25.0%
Not Always	Count	53	25	78
	% Leadership and error management	69.7%	89.3%	75.0%
	% of Total	51.0%	24.0%	75.0%
Total	Count	76	28	104
	% Leadership and error management	100.0%	100.0%	100.0%
	% of Total	73.1%	26.9%	100.0%

χ^2 = 3.193[b], df=1, N=104, p=0.074[b], Phi=0.200, Fisher's Exact Test p = 0.045
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.00.
b. Computed only for a 2x2 table

In all results in relation to near miss error, despite having a positive factor score, there were less than half of the respondents who indicated that they viewed the scenario would *Always* be disclosed.

Where factor scores for *teamwork and patient safety at bedside* and *leadership and error management* were positive, there was a greater likelihood that a severe error would be viewed as *Always* reported and all levels of error more likely to be viewed as *Always* disclosed. In addition, the moderate error scenario was more likely to be viewed as *Always* acknowledged if the factor score for *workplace safety climate* was positive.

There were no significant differences found between factor scores and views of reporting moderate or near miss error. In addition, no difference was found in views of reporting or disclosure of any error outcome in relation to the factor *workplace relationships and communication.*

5.10 Summary of variable-based results

The first part of this chapter has presented the variable-based results. This included an examination of the sample obtained as well as views of reporting and disclosure, safety climate data and the relationship between each of these.

Demographic data were, where possible, compared to workforce data to establish representativeness. It is possible that enrolled nurses may be under-represented in this sample along with relatively low responses from nurses working in the private sector. It was not possible to make an assessment on some other areas such as ASGC-RA representativeness for example.

The results presented in Sections 5.4 and 5.7 of this chapter outlined the results of this research in relation to nurses' views of reporting and disclosure of a hypothetical medication error. These results inform the first research sub-question: *what level of reporting and disclosure of different severity of a hypothetical* *medication error do nurses in rural clinical settings think is occurring?* Differences were noticed in these views with regard to workplace settings and work role.

Although, due to potential bias from the low sample size and subsequent issues relating to cell counts, caution is needed when interpreting the results of views relating to reporting of severe error, the results for moderate and near miss error suggest workplace setting may be of influence. Results for views of acknowledging error in the workplace in relation to all levels of harm also differed with regard to workplace setting. Aged care nurses were more likely to view the scenarios would be either reported or acknowledged in their workplace compared to nurses in other workplace settings.

Nurses working in a management role were more likely indicate they thought error would be disclosed in their workplace compared to nurses indicating their role was clinical. However, no difference was noted between managers and clinicians with respect to views of reporting error.

Sections 5.5 and 5.8 presented the results of the analysis of safety climate data which relate to the second research sub-question: *what is the nature of workplace safety climate amongst nurses in these settings?* This included the need to undertake an exploratory principal components analysis in order to determine a reliable factor structure on which to base teamwork and safety climate factor scores.

Similar findings emerged from these results where differences in teamwork and safety climate factor scores were found in relation to the demographic data. Once again workplace setting and work role were areas where differences were identified. Although facility size/bed numbers and regional location of the worksite exhibited differences in some factor scores it is possible these results were influenced by other factors such as the size of workplaces located in a particular region.

Aged care nurses and those working in community settings were more likely to have positive scores in the factor for *workplace safety culture*. This factor contains questions in relation to staffing levels, ability to learn from error and observations of behaviours relating to safety. It is the only factor where a difference in settings was noted.

In contrast, nurses in management roles were more likely to have a positive score in three of the four factors. These were *teamwork and patient safety at bedside, workplace safety culture* and *leadership and error management.* Once again, due to the potential bias associated with the sample caution is needed with regard to interpreting the results of the first of these factors. It is possible that the only area where there was no difference found is the second teamwork factor of *workplace relationships and communication.*

The third research sub-question of this research is: *what is the relationship between workplace safety climate amongst nurses in rural clinical settings and their views of reporting/disclosure of a hypothetical medication error?* Results relating to this sub-question were presented in Section 5.9. The analysis using inferential statistics found that respondents with positive scores for *teamwork and patient safety at bedside* and *leadership and error management* were more likely to view severe error as *Always* reported and all error scenarios as *Always* disclosed. In addition if the safety climate factor of *workplace safety culture* was positive the moderate error scenario was more likely to be considered *Always* acknowledged in the workplace.

These results are relatively straightforward when considered in respect to each individual research sub-question. However, the sub-questions have been developed to inform the overall research question of *how is safety climate related to views of reporting and disclosure of medication error amongst nurses working in rural clinical settings?* When this question is taken into account, several issues arise from the results.

For example, although nurses working in aged care settings were more likely to view errors as reported or disclosed the only teamwork and safety climate factor that was more likely to be positive amongst this group was *workplace safety culture.* The disclosure of the moderate scenario was more likely when this factor was positive but in relation to reporting or disclosure of other levels of harm there was no difference found.

Another example of the complicated nature of these results is the nurses in community settings were more likely to have a positive factor score for this same factor compared to nurses in rural hospital/multi-purpose settings but the community nurses were also less likely to view the moderate harm scenario to *Always* be disclosed compared to nurses in aged care.

Although these variable results have identified differences relating to safety climate and views of reporting and disclosure, these differences cannot be explained. Furthermore, some results are complicated as outlined above. Issues such as this will be explored in further detail in the following chapter (Section 6.1) once the case-based results have been presented.

Part II: Case-based results

Having undertaken the statistical analysis and identified that there are differences in nurses' views of error reporting and disclosure *Part II* of this chapter presents the analysis of the case-based configurations using *fsQCA*. These results relate to the third research sub-questions which is: *what is the relationship between workplace safety climate amongst nurses in rural clinical settings and their views of reporting/disclosure of a hypothetical medication error?*

A consistent approach to analysis has been outlined in the previous chapter (Section 4.8.3). Through adopting this consistency a transparent comparison of each of these outcomes is then possible.

The fsQCA results presented first are those relating to teamwork and safety climate and the likelihood the severe error outcome would *Always* be reported. It is recognised that many who read this thesis may not be familiar with either CCM or *fsQCA*. For this reason detailed information will be provided regarding this initial analysis with each step of the analysis being worked through in this chapter.

Once this has been done, results of a further analysis are presented where demographic data have been included as additional conditions. This allowed for a comparison of teamwork and safety climate factors amongst nurses in aged care settings compared to those in other settings and nurses working in a management role and compared to those in a clinical role.

5.11 Before the analytic moment

The first phase of the *funnel of complexity* is referred to as *before the analytic moment.* During this phase case selection, adoption of Boolean algebra expressions and transformation of raw data to form a calibrated data set for the conditions and outcome occur.

As outlined in *Part I* of this chapter (Section 5.6) there were four factors identified from the PCA. The two teamwork factors identified were *teamwork and patient safety at bedside* and *workplace relationships and communication* and the two safety climate factors were *workplace safety culture* and *leadership and error management.*

These four factors represent the conditions for analysis using *fsQCA.* The outcomes for the analysis are the views of reporting a severe, moderate and near miss error (each considered a separate outcome) as well as disclosure of these same outcomes (again analysed separately). The rationale for the conditions and outcomes has previously been discussed in the literature review and method chapter.

5.11.1 Case selection

In order to determine safety climate and teamwork scores for the *fsQCA* a response across all the SAQ items was required. Similarly, not all respondents provided an answer in relation to views of reporting or disclosing error.

In order to maintain transparency in the *fsQCA* analysis it was determined that responses to all items of the questionnaire were required. Therefore, only cases with full responses to both the SAQ questions and the views of reporting and disclosure were included for the *fsQCA*.

Of the total responses received there were 85 responses with fully completed questionnaires. These responses were given individual "case ID" numbers for the purpose of analysis and reporting of results.

Of these cases 45 were nurses working in a rural hospital/multi-purpose setting, 20 working in rural aged care environments and 16 indicated their work was located within a community setting. This left the remaining four cases where respondents worked in another work location.

With regard to work role, 16 of the respondents indicated *management* was their primary role. One of the remaining cases (*case 29*) did not indicate either *management* or *clinical* as their role. This case was allocated to the *not management* set. In the event this allocation resulted in the case being present as a contradictory case with respect to any outcome, then it would be possible to re-assign the case.

There were two cases included in the analysis that did not contain postcode data. These were *case 50* and *case 56.* Just as a conservative decision was made to include respondents with missing postcode data in the variable-based analysis, so too was the decision that was made to include them here. In the event the cases proved contradictory to the outcome this would clearly be identified through *fsQCA.* If this occurred then it would be possible to re-examine their inclusion.

5.11.2 Boolean algebra

It is recommended that appropriate terminology and Boolean expressions are used for analysis (Schneider & Wagemann, 2010). This is required for both the use of the software and interpretation of results. The expressions for each of these are outlined in Table 5-40. As noted in the previous chapter (Section 4.5) these expressions are based upon the outputs from *fs/QCA software (Ragin & Davey, 2012).*

As indicated in the previous chapter (Section 4.2.2) there has been an allocation of a *qualitative descriptor* in the naming of condition and outcome sets. This is a key aspect of *fsQCA* as it allows for the data to be described from the analysis (Schneider & Wagemann, 2012).

Table 5-40 *Boolean expressions for conditions, outcomes and solution terms*

Full terminology	Role in analysis	Boolean expression
Teamwork factor 1 (teamwork and patient safety at bedside) positive	Condition	tf1
Teamwork factor (workplace relationships and communication) 2 positive	Condition	tf2
Safety climate factor 1 (workplace safety culture) positive	Condition	scf1
Safety climate factor 2 (leadership and error management) positive	Condition	scf2
View of reporting severe error *Always*	Outcome	sr
View of reporting moderate error *Always*	Outcome	mr
View of reporting near miss error *Always*	Outcome	mmr
View of disclosure of severe error *Always*	Outcome	sd
View of disclosure of moderate error *Always*	Outcome	md
View of disclosure of near miss error *Always*	Outcome	nmd
Negated set (ie not 'in' the set)	Expression	~ (before set expression)
Logical 'OR'	Expression	+
Logical 'AND'	Expression	*

With conditions and outcomes determined through the literature review and calibration outlined in the previous chapter, the raw data were transformed to a calibrated data set. As noted in the previous chapter (Section 4.8.2) raw and calibrated data tables appear in Appendix 13 and Appendix 14.

5.11.3 Possible configurations

The formula used to determine the number of possible configurations in *fsQCA* is 2^k where *k* is the number of conditions (Schneider & Wagemann, 2012). Hence, with the four conditions of interest the total possible combinations of positive and not positive scores for teamwork and safety climate is 2^4 or sixteen. Table 5-41 shows these combinations. The number "1" in the table indicates the condition is present whilst "0" indicates the condition is absent.

Table 5-41 *Possible configurations of conditions of interest with number of cases*

tf1	tf2	scf1	scf2	No of cases
1	1	1	1	41
1	1	1	0	4
1	1	0	1	5
1	1	0	0	3
1	0	1	1	4
1	0	1	0	2
1	0	0	1	2
1	0	0	0	1
0	1	1	1	5
0	1	1	0	1
0	1	0	1	4
0	1	0	0	6
0	0	1	1	2
0	0	1	0	1
0	0	0	1	0
0	0	0	0	4

The configurations listed in Table 5-41 are presented in order of factor scores for each condition being *positive.* This has been done for easy comparison across all analyses. The same pattern of configurations will be used consistently for presenting the results of this research in matrix tables allowing for comparing across analyses for both views of reporting and disclosure as well as the different levels of harm.

The number of configurations present for each outcome is also listed in this table. The configuration with no cases present (~tf1 ~tf2 ~scf1 scf2) is the only *logical remainder.* As noted in the previous chapter (Section 4.8.4) in this research there were no directional assumptions made in relation to logical remainders.

5.12 Presentation of results

Results of analysis from *fsQCA* are presented in a series of figures and tables. Results from the *test of necessity* are presented first. Outputs from *fs/QCA software* for *test for necessity* are presented for the initial analysis for factors and views of reporting and disclosure in this chapter with remaining output data contained in Appendix 16. A sample data output for the *test of sufficiency* appears in this chapter.

Truth tables were produced for all conditions and outcomes. The truth table of the initial analysis of teamwork and safety climate factors and views of reporting severe error appears in this chapter. All remaining tables where a *test of sufficiency* was undertaken appear in Appendix 1 and Appendix 19. It is through consideration of the *truth table* that the *sufficiency cut-off* is determined. The guidelines developed in the previous chapter (Section 4.8.2) were applied when determining the *sufficiency cut-off* and in more than one analysis was undertaken for some outcomes. Once the *sufficiency cut-off* was determined the analysis for *sufficiency* was completed through the software and solution terms produced.

Solution terms from each analysis are presented in a separate results table. Cases found to be either consistent or inconsistent with the outcome for each solution term, are identified in these tables, all of which appear in this chapter.

As noted in the previous chapter (Section 4.8.3,) to assist in the process of presenting these results and comparing the data across different outcomes by means of a matrix a results key was developed (Table 5-42). Where a factor score was present for the outcome the difference of *positive* or *not positive* was represented by “1” (present) and “0” (not present) and colour coded green or red respectively. Lighter shades reflecting the same colours were used for demographic elements of workplace setting (aged care or not aged care) and work role (management role or not management role).

Each analysis (*Analysis X, Y, and Z*) is indicated as present for the outcome through use of the corresponding alphabetical symbol. Those configurations found present in the initial analysis (with no additional conditions) are shaded in grey in all matrix tables.

Table 5-42 *Key to fsQCA results tables*

Key	Representation
1	Factor score positive is present for the outcome
0	Factor score not positive is present for the outcome
1	Setting or role present for the outcome
0	Setting or role not present for the outcome
X	Configuration present for outcome when analysis sufficiency cut-off = 1.00000
Y	Configuration present for outcome when analysis sufficiency cut-off < 1.00000 and no inconsistent cases included in analysis
Z	Configuration present for outcome when analysis sufficiency cut-off < 1.00000 and inconsistent cases included in analysis

The analysis therefore proceeded under the parameters outlined in the previous chapter with results presented in a consistent manner. Further details of the results obtained *during the analytic moment* will now be provided.

5.13 During the analytic moment

The second phase of the *funnel of complexity* is *during the analytic moment* which occurs when the analysis proper is undertaken. This encompasses both the *test for necessity* and *test for sufficiency.*

5.13.1 Test for necessity

The concept of necessary conditions was discussed in the previous chapter (Section 4.7). This test is performed first.

The output from *fs/QCA software* (Ragin & Davey, 2012) for the *test for necessity* from the analysis of each individual teamwork and safety climate factor the views of reporting a severe error appears in Figure 5-16. None of the values for this analysis were found to have a consistency of 1.00. Therefore none of the conditions were found necessary for the outcome. Data outputs for the *test for necessity* for other outcomes appear in Appendix 16.

Analysis of Necessary Conditions

Outcome variable: sr

Conditions tested:

	Consistency	Coverage
tf1	0.875731	0.896825
~tf1	0.133787	0.746586
tf2	0.904555	0.882478
~tf2	0.101564	0.777315
scf1	0.843100	0.881826
~scf1	0.173895	0.871253
scf2	0.870156	0.896735
~scf2	0.142760	0.770359
rh	0.525493	0.858889
~rh	0.474507	0.872500
racf	0.241332	0.887500
~racf	0.758668	0.858462
rc	0.178790	0.821875
~rc	0.821210	0.875362
mx	0.203943	0.937500
~mx	0.796057	0.848551

Figure 5-16: fsQCA output for necessary conditions for factors and views of reporting severe error

5.13.2 Test for sufficiency factors and views of reporting severe error

Following the *test for necessity,* a *test for sufficiency* was performed. The truth table for factors and views of reporting of severe error is presented as Table 5-43. The rows are listed from most consistent to least consistent configuration and the row without any cases is a logical remainder.

In examining the truth table it is possible to see the most consistent row of configurations is the one where all factors are *positive* and the row with the configuration of all *not positive* factor scores the least consistent with the outcome. Although the configuration of all *positive* factor scores is the most consistent there

Table 5-43 *Truth table views of reporting severe error*

tf1	tf2	scf1	scf2	No	sr	Raw consist.	PRI consist.	Product	Cases consistent with row	Cases inconsistent with row
1	1	0	1	5	1	0.898865	0.893362	0.893362	22;32;43;48;52	
1	1	1	1	41	1	0.891151	0.888457	0.90282	1;2;3;4;6;8;11;12;13;15; 18; 19 20; 24; 26;29;30;34; 35; 37;38;46; 47;55;57; 59;61; 67;68;69;70;71;73;74; 76; 84;	9; 31;51;54;56
1	1	0	0	3	1	0.890805	0.868056	0.868056	10;65;78	
1	1	1	0	4	1	0.844933	0.830441	0.830441	7;25;58;82	
1	0	0	1	2	1	0.836120	0.803213	0.803213	41;83	
1	0	1	1	4	1	0.823276	0.809598	0.809598	17;40; 64;85;	
0	1	0	0	6	1	0.822844	0.785311	0.785311	14;16;81; 5	23;39
0	1	1	1	5	0	0.788321	0.781681	0.781681	28;36; 44;77	79
0	1	0	1	4	0	0.778761	0.765808	0.765808	42;53;66	62
1	0	0	0	1	0	0.753363	0.640523	0.640523		63
0	0	0	0	4	0	0.720588	0.641509	0.641509	49;75	60;72
0	0	1	1	2	0	0.705179	0.672566	0.672566	21;27	
0	1	1	0	1	0	0.704545	0.656891	0.656891	33	
1	0	1	0	2	0	0.570000	0.439130	0.439130	50	45
0	0	1	0	1	0	0.428571	0.333333	0.333333		80
0	0	0	1	0	0					

```
**********************
*TRUTH TABLE ANALYSIS*
**********************

File:  D:/Uni RH/Draft thesis Jan 09/aaa Aug 2015 corrections/QCA corrected/calibrated data
for analysis corrected worksite CSV.csv
Model: sr = f(tf1, tf2, scf1, scf2)

 Rows:      15


 Algorithm: Quine-McCluskey
      True: 1

--- COMPLEX SOLUTION ---
frequency cutoff: 1.000000
consistency cutoff: 0.823276

                 raw       unique
               coverage    coverage   consistency
              ----------  ----------  ----------
tf1*tf2       0.810741    0.067029    0.903211
tf1*scf2      0.801768    0.058056    0.903339
solution coverage: 0.868797
solution consistency: 0.909091

**********************
*TRUTH TABLE ANALYSIS*
**********************

File:  D:/Uni RH/Draft thesis Jan 09/aaa Aug 2015 corrections/QCA corrected/calibrated data
for analysis corrected worksite CSV.csv
Model: sr = f(tf1, tf2, scf1, scf2)

 Rows:      15


 Algorithm: Quine-McCluskey
      True: 1-L

--- PARSIMONIOUS SOLUTION ---
frequency cutoff: 1.000000
consistency cutoff: 0.823276

                 raw       unique
               coverage    coverage   consistency
              ----------  ----------  ----------
tf1*tf2       0.810741    0.067029    0.903211
tf1*scf2      0.801768    0.058056    0.903339
solution coverage: 0.868797
solution consistency: 0.909091

**********************
*TRUTH TABLE ANALYSIS*
**********************

File:  D:/Uni RH/Draft thesis Jan 09/aaa Aug 2015 corrections/QCA corrected/calibrated data
for analysis corrected worksite CSV.csv
Model: sr = f(scf2, scf1, tf2, tf1)

 Rows:       8

Algorithm: Quine-McCluskey
      True: 1
  0 Matrix: 0L
Don't Care: -

--- INTERMEDIATE SOLUTION ---
frequency cutoff: 1.000000
consistency cutoff: 0.823276
Assumptions:

                 raw       unique
               coverage    coverage   consistency
              ----------  ----------  ----------
scf2*tf1      0.801768    0.058056    0.903339
tf2*tf1       0.810741    0.067029    0.903211
solution coverage: 0.868797
solution consistency: 0.909091
```

Figure 5-17: fsQCA software output for all solution terms (factors and views reporting severe error) are five contradictory cases for that configuration. That is, of all cases with that configuration there were five cases where the nurse respondent indicated they felt the error would *Not always* be reported in their workplace.

Closer examination of the *truth table* revealed that amongst all the cases there were only 14 that were contradictory for the outcome.

Undertaking an analysis including contradictory cases is not ideal. The previous chapter outlined a consistent approach to the use of *fsQCA* designed to ensure comparison of multiple outcome sets. The approach applied for this analysis was to adopt *Analysis Z.* The *solution cut-off* was therefore set at 0.823276 which was greater than 0.80. This value allowed the inclusion of a contradictory row. However, as the proportion threshold was set at 0.85, no less than 85% of the cases included were contradictory. This ensured there were transparent levels at which any contradictory rows were included in any analysis.

The *fs/QCA software* output containing the complex, parsimonious and intermediate solution terms may be viewed in Figure 5-17 with solutions terms available in Table 5-44.   Use of *Kirq* software (Reichert & Rubinson, 2014) identified the any cases that were inconsistent with solution terms and these are also presented in this table. Through examining the result for this analysis it can be seen that two of the four solution terms contained the 5 inconsistent cases with the other two solutions fully consistent (consistency=1.00) for the outcome.

The solution statement is provided as:

> a *positive factor score* for *teamwork and patient safety at the bedside* (tf1) AND a *positive factor score* for *workplace communication and teamwork* (tf2) OR;

a *positive factor score* for *teamwork and patient safety at the bedside* (tf1) AND *positive factor score* for *leadership and error management* (scf2)

leads to the outcome of severe error viewed as *Always* reported.

This is quite a long statement. As a result, subsequent solution terms will not be stated fully. The Boolean expressions are present in the solution term tables and the configurational rows for the solution terms appears in the matrix tables.

Table 5-44 *Solution terms for factors view severe error Always reported (Analysis Z)*

Severe error *Always* reported	**tf1*tf2** +	**tf1*scf2**
Consistency	0.903211	0.903339
Raw coverage	0.810741	0.058056
Unique coverage	0.067029	0.058056
Cases consistent	1;2;3;4;6;8;11;12;13;15;17; 18;19;20;22;24;26;29;30;32; 34;35;37;38;40;41;43;46;47;48;52; 55;57;59;61;64;67;68;69;70;71;73; 74;76; 83;84;85	1;2;3;4;6;7;8;10;11;12;13;15;18; 19;20;22;24;25;26;29;30;34;32;35; 37;38;43;46;47;48;52;55;57;58;59; 61;65;67;68;69;70;71;73;74;76;78; 82;84;
Cases inconsistent	9;31;51;54;56	9;31;51;54;56
Consistency cut-off	0.823276	
Solution consistency	0.909091	
Solution coverage	0.868797	

There are *parameters of fit* that need to be noted. The *solution consistency* (0.91) indicates the large majority of the cases covered by the entire solution are consistent. The *solution coverage* is 0.87 and also indicates many of the cases are covered by this solution term and hold membership of the outcome set. From this table it is possible to identify it is five cases (cases 9, 31, 51, 54 and 56) that are contradictory for the outcome with respect to each of the solution terms.

The solution term paths were mapped into a matrix which can be seen in Table 5-45. There are two issues that should be noted in relation to the solution for this analysis. Firstly, consideration of the parsimonious solution term reveals no difference between it and other solution terms That is, when mapped in the matrix, the parsimonious solution does not alter the configurational rows covered by the intermediate solution.

The solution path tf1*tf2 is represented by rows 1-4 in the matrix table. The solution term tf1*scf2 is represented by rows 1, 3, 5 and 7. The unshaded conditions within each of these rows is not relevant to the outcome. Whilst it is possible to differentiate in relation to this particular set of solution term for the condition of teamwork and safety climate factors and the outcome of views of reporting severe error, for the purposes of comparison through other matrices it is necessary to highlight

Table 5-45 *Presence of rows in solution terms (views of reporting severe error)*

Factors				'Always' report severe error		
Teamwork and patient safety at bedside (tf1)	Workplace relationships and communication (tf2)	Workplace safety culture (scf1)	Leadership and error management (scf2)	Complex	Parsimonious	Intermediate
1	1	1	1	Z	Z	Z
1	1	1	0	Z	Z	Z
1	1	0	1	Z	Z	Z
1	1	0	0	Z	Z	Z
1	0	1	1	Z	Z	Z
1	0	1	0			
1	0	0	1	Z	Z	Z
1	0	0	0			
0	1	1	1			
0	1	1	0			
0	1	0	1			
0	1	0	0			
0	0	1	1			
0	0	1	0			
0	0	0	1			
0	0	0	0			

Analysis for other outcomes (views of reporting moderate and near miss error and views of disclosure of severe and moderate error and the negated (non-outcome set) for views of disclosure of moderate and near miss error were also undertaken. However, the sufficiency cut-off for each of these varied making direct comparison difficult. The addition of further conditions was considered in order to address this matter and this is discussed in more detail in the next section.

Analysis of the outcome sets for disclosure of near miss error as well as the negated (non-outcome set) for views of moderate reporting, near miss reporting and severe error disclosure were not pursued to fsQCA. These truth tables contained configurations where it was either not possible to set a sufficiency threshold that was at or above the 0.80 threshold set for this research, or there were rows present with contradictory cases that could not be resolved with a proportion threshold of 0.85 (85%) or greater (Rubinson, 2013). In addition, some truth tables, although exhibiting sufficiency consistency of ≥0.80, the PRI and PRODUCT were lower than the 0.75 threshold set for this research (Section 4.8.3). The relevant truth tables for these appear in Appendix 17 with the solution tables presented in Appendix 18. A table of the configurational rows represented by the solution terms for each of these was not produced due to different consistency cut-off values for each analysis.

As noted earlier in the previous chapter, it is possible to resolve contradictory rows through adding conditions. This approach was taken as it produced improved consistency cut-off thresholds allowing for a comparison across multiple outcomes. The results of this further analysis will now be presented.

5.14 Case-based relationship including workplace setting and work role

Several options for resolving contradictory rows were discussed in the previous chapter (Section 4.7.3) (Rubinson, 2013; Schneider & Wagemann, 2012; Ragin, 2009). A proportional threshold of 0.80 was applied to the previous analysis and cases with low consistency but present for the outcome were determined to be *not present* (coded as "0"*)*. Other options include re-examine cases and adding conditions.

A re-examination of the cases of this research with respect to demographic information resulted in the addition of workplace setting and work role as conditions for analysis. This decision was also supported through the variable-based inferential statistics results where workplace setting and work role were areas where differences in views of reporting and disclosure as well as some teamwork and safety climate factors were noted.

The rationale for adding conditions for further analysis was not based solely on resolving contradictions. The variable-based results relating to the disclosure of severe, moderate and near miss error clearly identified that nurses in residential aged care settings viewed such errors as more likely to be disclosed compared to the nurses in rural hospital or community settings. Nurses working in management roles were also more likely to view error to be disclosed. With this in mind additional conditions were added for further analysis with *fsQCA*.

As these additional conditions of interest were specific to aged care nurses compared to nurses who were not working in aged care, as well as nurses working in management roles compared to those who were not, then the additional conditions created focused on the presence or absence of each. Thus, the conditions added were a *crisp set* category where each was either present (*1*) or absent (*0*).

Adding conditions resolved some of the inconsistent rows and improved PRI and PRODUCT consistency levels which enabled analysis to go ahead. However, it also raised the number of possible configurations of conditions from 16 to 64 resulting in 37 *logical remainders*. These may be viewed in the *truth tables* produced for the *test of sufficiency* (Appendix 19).

The majority of these *logical remainders* were present amongst the nurses working in residential aged care settings. There were also more present amongst nurses in management roles in aged care compared to those employed in a clinical role in that same workplace setting.

5.14.1 Test for necessity additional conditions

Once again, the first test for analysis with the additional conditions was that for necessity. Necessary conditions were found relating to demographic data include membership of the set *not working in aged care* (~racf consistency=1.00) and *not management* (~mx consistency=0.91) for the *Not always* outcome for reporting of severe error. The condition ~racf was also found necessary for the *Not always* set for disclosure of severe (consistency=0.95) and moderate error (consistency=0.92). The presence of this condition as necessary for the outcome of *Not always* acknowledging near miss error was close to the 0.9 threshold with a consistency of 0.89.

As noted previously, all *fs/QCA software* outputs for the test for necessary conditions may be found in Appendix 16.

5.14.2 Test for sufficiency

Analyses for the outcomes relating to views of reporting error were undertaken using consistency cut-off of 1.00 (*Analysis X*). Similarly, analyses for outcomes relating to views of disclosure were also undertaken with the same consistency cut-off of 1.00 (*Analysis X)* as were analyses for the negated outcome for near miss reporting and all negated (non-outcome sets) for views of disclosure. This approach of using the same level of sufficiency consistency makes a comparison across the different outcomes possible. The truth tables for each of these analyses appear in Appendix 19

It should be noted here that *case 50* and *case* 56, the two cases with not post-code that were included in the analysis (refer to Section 5.11.1), were varied in whether or not they were contradictory to any of the outcomes of interest. Both cases were either consistent for the outcomes relating to views of *Always* reporting or acknowledging error or where inconsistent there were also other cases that were inconsistent for that same outcome. Therefore the inclusion of these cases did not lead to contradictory rows being included in the analysis.

Each analysis was undertaken through assessment of solution consistency where PRI and PRODUCT values were appropriate. Each analysis will now be considered separately prior to the comparison using the multiple outcomes analysis.

Table 5-46 *Solution terms for view that severe error Always reported including workplace setting and work role*

Severe error *Always* reported	**~tf1*tf2*scf2*racf*~mx** +	**tf1*~tf2*scf2*~racf*mx** +
Consistency	1.000000	1.000000
Raw coverage	0.023929	0.013868
Unique coverage	0.023929	0.013868
Cases consistent	44;53	17;83
Cases inconsistent	Nil	Nil
	tf1*tf2*scf1*racf*mx +	**tf1*tf2*scf2*racf*mx**
Consistency	1.000000	1.000000
Raw coverage	0.084976	0.088239
Unique coverage	0.006934	0.010197
Cases consistent	6;12;18;26;30;58	6;12;18;26;30;48
Cases inconsistent	Nil	Nil
Consistency cut-off	1.000000	
Solution consistency	1.000000	
Solution coverage	0.132971	

The paths and overall solution for the analysis of factors and demographic conditions for the outcome that the severe error was *Always* likely to occur appear in Table 5-46. This analysis included no contradictory rows and therefore the solution cut-off and overall solution consistency was 1.00. The coverage was 0.13. All configurational pathways had a consistency of 1.00 with the pathway ~tf1*tf2*scf2*racf*~mx having a raw and unique coverage of 0.02 and pathway tf1*~tf2*scf2*~racf*mx a raw and unique coverage of 0.01. The pathways tf1*tf2*scf1*racf*mx and tf1*tf2*scf2*racf*mx had raw coverage of 0.08 and 0.09 respectively. However, the unique coverage for each was also 0.01.

Analysis relating to the outcome that the moderate error was likely to *Always* be reported may be seen in Table 5-47. This solution term has a consistency of 1.00 and coverage of 0.04. The raw and unique coverage for each pathway were the same values with ~tf1*tf2*scf2*racf*~mx having coverage values of 0.03 and tf1*~tf2*~scf1*scf2*~racf*mx and tf1*tf2*~scf1*scf2*racf*mx a raw and unique coverage of 0.01.

Table 5-47 *Solution terms for views moderate error Always reported including workplace setting and work role*

Moderate error *Always* reported	**~tf1*tf2*scf2*racf*~mx** +	**tf1*~tf2*~scf1*scf2*~racf*mx** +
Consistency	1.000000	1.000000
Raw coverage	0.026210	0.007595
Unique coverage	0.026210	0.007595
Cases consistent	44;53	83
Cases inconsistent		
	tf1*tf2*~scf1*scf2*racf*mx +	
Consistency	1.000000	
Raw coverage	0.011169	
Unique coverage	0.011169	
Cases consistent	48	
Cases inconsistent		
Consistency cut-off	1.000000	
Solution consistency	1.000000	
Solution coverage	0.044974	

A solution such as this may be regarded as trivial due to the low representation of cases (Ragin, 2006). However, it could also be argued that as the subject matter of this research is patient safety, that any configuration leading to the outcome of interest is significant, regardless of the level of representation within the cases. That is, whilst one of the rows of the truth table represents twenty-three of the 85 cases included, just one is fully consistent with the solution term for the outcome that the near miss error would *Always* be reported. This case is therefore unusual and warrants further investigation which would have been possible in the event that data obtained for this research were re-identifiable.

Results pertaining to factors, workplace setting and work role and the outcome of the view near miss error would *Always* be reported appear in Table 5-48. There was just one path for this solution, although the coverage was less than 0.01.

Table **5-48** *Solution terms views near miss error Always reported including workplace setting and work role*

Near miss error *Always* reported	**tf1*~tf2*~scf1*scf2*~racf*mx**
Consistency	1.000000
Raw coverage	0.009427
Unique coverage	0.009427
Cases consistent	83
Cases inconsistent	
Consistency cut-off	1.000000
Solution consistency	1.000000
Solution coverage	0.009427

This low solution coverage value is a concern when considering the solution represents a single case (*case 83*). A solution such as this may be regarded as trivial due to the low representation of cases (Ragin, 2006). However, it could also be argued that as the subject matter of this research is patient safety, that any configuration relating to the outcome of interest is important. That is, whilst this case is just one of 85 included in this research, it is the only one fully consistent with the outcome that near miss error would *Always* be reported. This is therefore an unusual case and warrants further investigation. This would have been possible in the event that data obtained for this research were re-identifiable.

Table 5-49 *Solution terms for view near miss error always reported (negated outcome including workplace setting and work role*

Near miss error *Always* reported (negated)	**~tf2*~scf1*~scf2*~racf*~mx +**	**tf1*~tf2*~scf1*~racf*~mx +**
Consistency	1.000000	1.000000
Raw coverage	0.049515	0.064725
Unique coverage	0.001295	0.016505
Cases consistent	49;72;63	41;63
Cases inconsistent		
	tf1*tf2*scf1*~scf2*racf*mx +	
Consistency	1.000000	
Raw coverage	0.016505	
Unique coverage	0.016505	
Cases consistent	58	
Cases inconsistent		
Consistency cut-off	1.000000	
Solution consistency	1.000000	
Solution coverage	0.082524	

This is in contrast to the results presented in Table 5-49 which presents the solution terms for the negated set of the view that near miss error would *Always* be reported. The coverage of the solution for this outcome was 0.08. Five cases (*cases 41, 49, 58, 63 and 72*) were consistent with this solution.

Other non-outcome (negated outcome sets) for views of error reporting were not analysed with fsQCA. Again this was due to the parameters set for this research not being achieved. As noted previously, these truth tables may be seen in Appendix 19.

Table 5-50 *Solution terms for views severe error Always disclosed including workplace setting and work role*

Severe error *Always* acknowledged	**tf1*~tf2*scf2*~racf*mx +**	**tf1*tf2*~scf1*scf2*racf*mx**
Consistency	1.000000	1.000000
Raw coverage	0.016846	0.012386
Unique coverage	0.016846	0.012386
Cases consistent	17;83	48
Cases inconsistent		
Consistency cut-off	1.000000	
Solution consistency	1.000000	
Solution coverage	0.029232	

Analysis undertaken with respect to the outcome that severe error would *Always* be acknowledged to the patient/client or their family is presented in Table 5-50. These results indicate that this solution has a consistency of 1.00 and coverage of 0.03. Three cases were consistent with this solution (*cases 17, 48 and 83*).

Table 5-51 *Solution terms for views moderate error Always disclosed including workplace setting and work role*

Moderate error *Always* **acknowledged**	**tf1*~tf2*~scf1*scf2*~racf*mx**
Consistency	1.000000
Raw coverage	0.009206
Unique coverage	0.009206
Cases consistent	17;83
Cases inconsistent	
Consistency cut-off	1.000000
Solution consistency	1.000000
Solution coverage	0.009206

The solution for the outcome relating to the view a moderate error was likely to *Always* be disclosed also had a consistency of 1.00. This result may be seen in Table 5-53. The solution coverage, raw and unique coverage) of this solution was 001. Only *case 17 and case 83* were consistent with this solution.

Table 5-52 *Solution terms for views near miss error Always disclosed including workplace setting and work role*

Near miss error *Always* **acknowledged**	**tf1*~tf2*~scf1*scf2*~racf*mx**
Consistency	1.000000
Raw coverage	0.012201
Unique coverage	0.012201
Cases consistent	83
Cases inconsistent	
Consistency cut-off	1.000000
Solution consistency	1.000000
Solution coverage	0.012201

Analysis was also performed with respect to the outcome that a near miss error would *Always* be disclosed. The result for this appears in Table 5-52. The solution term is a single path with a solution consistency of 1.00 and solution coverage, unique and raw coverage of 0.01. Once again, the single case represented by a single pathway and the low solution coverage should be noted.

Table 5-53 *Solution terms for views severe error Always disclosed including workplace setting and work role*

Severe error *Always* acknowledged (negated)	**~tf1*~scf1*~scf2*racf*~mx** +	**~tf1*tf2*~scf2*racf*~mx** +
Consistency	1.000000	0.829545
Raw coverage	0.062577	0.059714
Unique coverage	0.021268	0.028630
Cases consistent	60;75;39	33;39
Cases inconsistent		
	~tf1*tf2*~scf1*racf*~mx +	**tf1*~tf2*scf1*~scf2*racf*~mx** +
Consistency	1.000000	1.000000
Raw coverage	0.051943	0.041309
Unique coverage	0.020859	0.020859
Cases consistent	39;53	45
Cases inconsistent		
	tf1*tf2*scf1*~scf2*racf*mx	
Consistency	1.000000	
Raw coverage	0.020859	
Unique coverage	0.020859	
Cases consistent	58	
Cases inconsistent		
Consistency cut-off	1.000000	
Solution consistency	0.926108	
Solution coverage	0.153783	

Results presented in Table 5-53, indicate results pertaining to the negated (non-outcome set) indicating views that severe error would *Not always* be disclosed. The sufficiency cut-off of 1.00 produced a solution with a consistency of 0.93 and a solution coverage of 0.15. This solution represents seven cases *(case 33, 39, 45, 53, 58, 60, and 75)*. The pathway tf1*tf2*scf1*~scf2*racf*mx shows a raw and unique coverage of 0.02 with only *case 58* consistent. Another pathway, tf1*~tf2*scf1*~scf2*racf*~mx, is also represented by a single case (*case45*) and shows a raw coverage of 0.04 and unique coverage of 0.02. Two other pathways, ~tf1*~scf1*~scf2*racf*~mx and ~tf1*tf2*~scf1*racf*~mx have raw coverage of 0.06 and 0.04 respectively and both have unique coverage of 0.02. The former of these pathways represents three consistent cases and the latter is represented by two. The remaining pathway, ~tf1*tf2*~scf2*racf*~mx covers two consistent cases and has a raw coverage of 0.06 and unique coverage of 0.03. This solution term has a consistency of 0.83, indicating it is less consistent that the other pathways in the solution term.

All paths in this solution term contain the condition *racf.* That is, the outcome is only seen when the condition *racf* is present, suggesting this condition is *necessary.* However, the *test for necessity* did not indicate that *racf* is a *necessary* condition. This is referred to as a *false necessary* condition (Section 4.7) and is a possible indication that set membership scores may be "skewed" (Schneider & Wagemann, 2012, p 249). Further support for the *false necessity* is that there are examples in the data where the condition *racf* is not present for the outcome.

The solution term for the non-outcome (negated) set for views of disclosure of moderate error has multiple pathways, all of which have a consistency of 1.00. This is the same value as the overall solution consistency and the solution coverage is 0.21. This may be seen in Table 5-54.

Of these, the pathways tf1*~tf2*~scf1*~racf*~mx and ~tf1*~tf2*~scf1*~scf2*~mx have the highest raw coverage of 0.07 for each. The former (with two consistent cases) has a unique coverage of 0.03 and the latter (with four consistent cases) a unique coverage of 0.00. Similarly, the pathways ~tf1*~tf2*~scf2*~racf*~mx and ~tf1*~scf1*~scf2*racf*~mx (each with three consistent cases) have a raw coverage of 0.05 but the former has a unique coverage of 0.02 and the latter 0.00.

Table 5-54 *Solution terms for views moderate error Always disclosed including workplace setting and work role*

Moderate error Always acknowledged (negated)	**~tf1*~tf2*~scf2*~racf*~mx +**	**tf1*~tf2*~scf1*~racf*~mx +**
Consistency	1.000000	1.000000
Raw coverage	0.051689	0.067568
Unique coverage	0.017230	0.034459
Cases consistent	49;72;80	41;63
Cases inconsistent		
	~tf1*tf2*~scf2*racf*~mx +	**~tf1*tf2*~scf1*racf*~mx +**
Consistency	0.829545	1.000000
Raw coverage	0.049324	0.042905
Unique coverage	0.023649	0.017230
Cases consistent	33;39	39;53
Cases inconsistent		
	tf1*~tf2*scf1*~scf2*racf*~mx +	**tf1*tf2*scf1*~scf2*racf*mx +**
Consistency	1.000000	1.000000
Raw coverage	0.034122	0.017230
Unique coverage	0.017230	0.017230
Cases consistent	45	58
Cases inconsistent		
	~tf1*~tf2*~scf1*~scf2*~mx +	**~tf1*~scf1*~scf2*racf*~mx**
Consistency	1.000000	1.000000
Raw coverage	0.068919	0.051689
Unique coverage	0.000000	0.000000
Cases consistent	49;60;72;75	39;60;75;
Cases inconsistent		
Consistency cut-off	1.000000	
Solution consistency	0.954614	
Solution coverage	0.213176	

The pathway ~tf1*tf2*~scf2*racf*~mx also has a raw coverage of 0.05 and has two consistent cases. This pathway has a unique coverage of 0.02.

The remaining three pathways ~tf1*tf2*~scf1*racf*~mx (with three consistent cases), tf1*~tf2*scf1*~scf2*racf*~mx and tf1*tf2*scf1*~scf2*racf*mx (each with two consistent cases) have a raw consistency of 0.04, 0.03 and 0.02 respectively. Each of these have the same unique consistency of 0.02.

Table 5-55 *Solution terms for view near miss error Always disclosed (negated outcome including workplace setting and work role)*

Near miss error *Always* acknowledged (negated)	**~tf2*~scf2*~racf*~mx +**	**~tf1*tf2*racf*~mx +**
Consistency	1.000000	0.933775
Raw coverage	0.059028	0.065278
Unique coverage	0.006019	0.047685
Cases consistent	49;50;72;80;63	33;39;44;53
Cases inconsistent		
	tf1*~tf2*~scf1*~racf*~mx +	**tf1*~tf2*scf1*~scf2*~mx +**
Consistency	1.000000	1.000000
Raw coverage	0.046296	0.069444
Unique coverage	0.011806	0.011806
Cases consistent	50;63;	45;50
Cases inconsistent		
	tf1*tf2*scf1*~scf2*racf*mx +	**~tf1*~tf2*~scf1*~scf2*~mx +**
Consistency	1.000000	1.000000
Raw coverage	0.011806	0.047222
Unique coverage	0.011806	0.000000
Cases consistent	58	49;60;72;75
Cases inconsistent		
	~tf1*~scf1*~scf2*racf*~mx	
Consistency	1.000000	
Raw coverage	0.035417	
Unique coverage	0.000000	
Cases consistent	39;60;75;	
Cases inconsistent		
Consistency cut-off	1.000000	
Solution consistency	0.974587	
Solution coverage	0.177546	

It is worth revisiting the concept of raw and unique coverage here. As outlined in Section 4.9, raw coverage is a measure of how much the membership of the outcome is covered by the respective single path whereas the unique coverage is how much that single path uniquely covers (Schneider & Wagemann, 2012). The two abovementioned pathways with unique coverage of 0.00 indicate the cases in these pathways are also covered by other solution terms. Each of these paths have raw consistency at values similar to other paths so they comprise similar membership of the outcome to those paths. However, these solution paths with a coverage of 0.00 are not themselves unique as the cases covered by these solutions are also covered by other paths. The non-outcome (negated outcome set) for views of disclosing near miss error was also analysed with respect to factors and the additional conditions of workplace setting and work role . Results may be viewed in Table 5-55. The solution consistency was 1.00 and solution coverage 0.04.

It has been suggested that truth tables alone may be of use in analysis (Collier, 2014). For example, they indicate that the most consistent configuration for the non-occurrence of some outcomes (negated) is not the configuration where all factor scores are not positive. Similarly, the truth tables for views of reporting moderate and near miss error, as well as severe, moderate and near miss disclosure indicate that the least consistent configuration is that where all factors are positive.

This is an indication of the complexity of safety climate found in the case-based results. The multiple outcome analysis provides further support of this complexity.

5.15 Multiple outcome analysis

As outlined in the previous chapter (Section 4.8.3) through selecting a consistency cut-off of 1.00 for each analysis with fsQCA a comparison of the outcomes was also possible. Thus, having completed each analysis, the results of each outcome were compared. Two approaches were undertaken for this. Firstly, the number of cases and the solution consistency of each solution statement were compared. Secondly a matrix was developed displaying the configurational rows present in the solution terms for each outcome.

In undertaking this further analysis of the fully consistent configurational rows it should be noted that there are examples within the truth tables of the outcome occurring that are not explained by the solution terms in the tables above. That is, there are examples of configurational rows with a consistency less than 1.0 where the cases exhibited the outcome of interest.

Table 5-56 *Comparison of number of cases and solution consistency of solution terms for each outcome*

Outcome	Always report severe	Always report moderate	Always report near miss	Always disclose severe	Always disclose moderate	Always disclose near miss
Cases (number)	11	4	1	3	2	1
Solution coverage	0.13	0.04	<0.01	0.03	<0.01	0.01
Outcome	**Always report severe (negated)**	**Always report moderate (negated)**	**Always report near miss (negated)**	**Always disclose severe (negated)**	**Always disclose moderate (negated)**	**Always disclose near miss (negated)**
Cases (number)	N/A	N/A	5	7	13	13
Solution coverage	N/A	N/A	0.08	0.15	0.21	0.18

Through selecting only those configurational rows and cases with full consistency then a transparent comparison is possible between all the different outcomes for views of reporting and disclosure. This aids in meeting the aim of this research to *describe describe the complexity of safety climate of nurses working in rural clinical settings.* Thus the results presented in Section 5.14 and this current section reflect a description of the fully consistent cases in the data.

The comparison of the number of cases and solution consistency appear in Table 5-56. From this comparison it is apparent that more cases were covered by solution terms where nurses felt the severe outcome would *Always* be reported (11 cases) compared to the same view in relation to moderate (4 cases) and near miss error (1 case). Fewer cases were covered by solution terms where nurses thought the severe error would *Always* be disclosed compared to moderate (2 cases) and near miss (1 case).

In all outcomes where solution terms were produced for both the outcome and the non-outcome (negated) set, there were more cases in the latter than the former. There were 5 cases covered by the solution which indicated the outcome that a near miss would *Not always* be reported compared to just 1 case for the outcome it would *Always* be reported. Similarly, 7 cases were represented by the solution term for severe disclose *Not always* being disclosed (compared to 3 covered for the outcome set) and 13 cases consistent for the outcome that moderate and near miss error would *Not always* be disclosed compared to 3 cases and two cases for the outcome of each respectively.

Thus more cases were identified as fully consistent with the non-outcome sets compared to the outcome. In addition, more cases were fully consistent with the outcome that a severe error would be reported than the outcome (non-negated) set for any other scenario. The outcome sets with a higher number of cases therefore also displayed higher solution coverage.

This suggests that the relationship between the different solution terms for each outcome and non-outcome (negated) set varied. This may be a reflection of the manner in which both policy and research focus on what is needed to ensure severe error is reported and why all error is not reported (a *Safety I* approach) rather than focussing upon what is required for error of all outcomes to be reported and disclosed (*Safety II* approach). This will be considered further in Chapter 3 (Section ADDITHERE)

The visual matrix representation of configuration rows found present from the analysis for each outcome may be seen in Table 5-57. Two initial observations can be made from this table.

Firstly, the configuration row where all factor scores are *positive* was only present for views of reporting severe error amongst nurses working in management roles in aged care settings. For nurses working in other settings and/or working in a clinical role this configuration was not consistent for the severe error being reported.

As with the first analysis, there are other configurations present for the outcome. That is, a view that the particular outcome would be reported and/or disclosed was possible even though some of the factor scores were *not positive.* This challenges

Table 5-57 *Matrix of configurations present for outcome set*

Teamwork and safety at bedside (tf1)	Workplace relationships and communication (tf2)	Workplace safety climate (scf1)	Leadership and management of error (scf2)	Work in aged care	Work in management role	Always report severe error	Always report moderate error	Always report near miss error	Always report severe error (negated)	Always report moderate error (negated)	Always report near miss error (negated)	Always disclose severe error	Always disclose moderate error	Always disclose near miss error	Always disclose severe error (negated)	Always disclose moderate error (negated)	Always disclose near miss error (negated)	Work in aged care	Work in management role	Always report severe error	Always report moderate error	Always report near miss error	Always report severe error (negated)	Always report moderate error (negated)	Always report near miss error (negated)	Always disclose severe error	Always disclose moderate error	Always disclose near miss error	Always disclose severe error (negated)	Always disclose moderate error (negated)	Always disclose near miss error (negated)
1	1	1	1	1	1	X												0	1												
1	1	1	0	1	1	X				X	X					X	X	0	1												
1	1	0	1	1	1	X	X											0	1												
1	1	0	0	1	1													0	1												
1	0	1	1	1	1													0	1	X						X					
1	0	1	0	1	1													0	1												
1	0	0	1	1	1													0	1	X	X	X				X	X	X			

1	0	0	0	1	1													0	1												
0	1	1	1	1	1													0	1												
0	1	1	0	1	1													0	1												
0	1	0	1	1	1													0	1												
0	1	0	0	1	1													0	1												
0	0	1	1	1	1													0	1												
0	0	1	0	1	1													0	1												
0	0	0	1	1	1													0	1												
0	0	0	0	1	1													0	1												
1	1	1	1	1	0													0	0												
1	1	1	0	1	0													0	0												
1	1	0	1	1	0													0	0												
1	1	0	0	1	0													0	0												
1	0	1	1	1	0													0	0												
1	0	1	0	1	0									X	X	X	0	0												X
1	0	0	1	1	0												0	0						X					X	X
1	0	0	0	1	0												0	0						X					X	X

0	1	1	1	1	0	X	X										X	0	0												
0	1	1	0	1	0										X	X	X	0	0												
0	1	0	1	1	0	X	X								X	X	X	0	0												
0	1	0	0	1	0										X	X	X	0	0												
0	0	1	1	1	0													0	0												
0	0	1	0	1	0													0	0											X	X
0	0	0	1	1	0													0	0												
0	0	0	0	1	0										X	X	X	0	0							X				X	X

the view that positive safety climate needs to be present if error is to be reported and disclosed.

Secondly, the configuration where all factor scores are *not positive* was present for the non-outcome (negated) set amongst nurses working in clinical roles in aged care and non-aged care settings. However, the configurational row present varied between each setting. This configurational row was o present for the non-outcome (negated) set for views relating to all outcomes for error disclosure in aged care. However it was present for the non-outcome (negated) set for views of reporting near miss error and views of disclosure of moderate and near miss error in non-aged care settings. This result challenges the concept that if safety climate is not positive then error will not be viewed as reported as this configurational row was not present for all of the non-outcome (negated) for all error outcomes, nor was it present for any outcome amongst nurses working in a management role.

Further observations of the configurations present for different outcomes, severity of harm, workplace settings and work roles may also be made. Differences in configurations may also be found when comparing outcomes for reporting and disclosure as well as between these two outcome groups. Further comparison is also possible through comparing the views of reporting and disclosure between the non-outcome (negated) for each of the different error scenarios. The production of smaller tables containing the relevant outcomes and configurations assists in the process of reporting the case-based results.

5.15.1 Case-based comparison views of reporting

The configurational rows present for the outcomes and negated (non-outcome) that the severe, moderate or near miss scenario would *Always* be reported appear in Table 5-58. This comparison matrix shows the number of cases found for each configurational row

Table 5-58 *Configurations present for outcome: view that error Always reported including workplace setting and work role*

Teamwork and safety at bedside (tf1)	Workplace relationships and communication (tf2)	Workplace safety climate (scf1)	Leadership and management of error (scf2)	Work in aged care	Work in management role	Always report severe error	Always report moderate error	Always report near miss error	Always report severe error (negated)	Always report moderate error (negated)	Always report near miss error (negated)	Work in aged care	Work in management role	Always report severe error	Always report moderate error	Always report near miss error	Always report severe error (negated)	Always report moderate error (negated)	Always report near miss error (negated)	Work in aged care	Work in management role	Always report severe error	Always report moderate error	Always report near miss error	Always report severe error (negated)	Always report moderate error (negated)	Always report near miss error (negated)	Work in aged care	Work in management role	Always report severe error	Always report moderate error	Always report near miss error	Always report severe error (negated)	Always report moderate error (negated)	Always report near miss error (negated)
1	1	1	1	1	1	1						0	1							1	0							0	0						
1	1	1	0	1	1	7				7	7	0	1							1	0							0	0						
1	1	0	1	1	1	1	1					0	1							1	0							0	0						
1	0	1	1	1	1							0	1	1						1	0							0	0						
1	0	0	1	1	1							0	1	1	1	1				1	0							0	0						1
1	0	0	0	1	1							0	1							1	0							0	0						1
0	1	1	1	1	1							0	1							1	0	1	1					0	0						
0	1	0	1	1	1							0	1							1	0	1	1					0	0						
0	0	0	0	1	1							0	1							1	0							0	0						2

and it can be seen the configurational rows were found to be different relating to severity of harm, workplace setting and work role.

The previously noted comments relating to the configuration of all positive factor scores and all not positive factor scores is also relevant here. The row containing all positive score was present only for the outcome that the severe error scenario would Always be reported. It was a single case – a nurse working in a management role in aged care.

In contrast, the configuration where all factor scores were not positive was found present amongst two nurses in working in non-aged care clinical roles and this was only present for the outcome that the near miss error would *Not always* be reported.

Although some configurational rows observed in this sample were present for more than one outcome, where this occurred they were grouped together in either outcome or negated (non-outcome) scenario. Of interest is the seven cases with the configurational row of tf1*tf2*scf1*~scf2*racf*mx where this row was observed to be present that the severe error scenario would *Always* be reported but also present for the non-outcome (negated) view of the moderate and near miss error *Not always* being reported. This demonstrates both the asymmetrical nature of the relationship between teamwork and safety climate factors and views of reporting as well as the complexity of that relationship. This will be discussed further in the next chapter (Section 6.2).

There were a similar number of configurational rows present amongst the nurses working in aged care settings compared to those working in other settings. However, there were also more cases within aged care settings compared to those in non-aged care. This result also mirrors the variable-based results. Aged care nurses were more likely to view error to be reported. Configurational rows present for the outcome for each level of harm also varied based upon work role. There were more cases amongst those in a management role compared to those in a clinical role.

Of interest is that the configurational rows for the negated (non-outcome) sets were amongst nurses in aged care working in management roles and those working in clinical roles in non-aged care settings. Also of note here are the results relating to views of reporting severe error. The variable-based results found no differences relating to views of reporting yet there are clear differences in relation to the case-based results with different configurational rows observed for this outcome across different settings and role.

The use of fsQCA has allowed for a description of the factors of teamwork and safety climate amongst nurses in different settings, working in different roles and with respect to views of reporting a hypothetical medication error with different levels of harm. The results from the analysis allow for describing the complex nature of this relationship based upon considering the information obtained from nurses on a case-by-case basis. Further consideration of this complexity and interpretation of the results will be undertaken in the following chapter (Sections 6.2 and 6.3).

5.15.2 Case-based comparison views of disclosure

Similar results were found in the analysis relating to views of disclosure of the same error scenario. The visual presentation of these results is presented in Table 5-59 will also be considered on the basis of severity of harm, workplace setting and work role.

However, it should first be noted that the configurational row for all positive teamwork and safety climate factor scores was not observed for the outcome that any of the scenarios would *Always* be disclosed. The notion that positive teamwork and safety climate factors contribute to error reporting and disclosure may not be supported by these results.

The configurational row of all *not positive* factor scores was present amongst five cases, all of which were nurses working in a clinical role. This configuration was present for all the non-outcome (negated) that the error would *Not always* be disclosed amongst nurses in aged care settings but was only present for the non-outcome for the moderate and near miss scenario amongst nurses working in clinical settings.

This same configurational row was not observed amongst nurses working in management roles, nor was it observed for any of the outcomes or non-outcomes relating to views an error scenario would *Always* be reported. Once again, this challenges the notion that when safety climate is not positive error reporting and disclosure may not always occur.

Differences can be seen once again when comparing configurational rows present for different levels of harm. Only one configuration row (tf1*~tf2*~scf1*scf2*~racf*mx) with a single consistent case was present for the view amongst all outcomes that an error scenario would *Always* be disclosed. This compares to numerous configurational rows, three of which had more than one consistent case, for the negated (non-outcome) for the three scenarios. This indicates more cases and pathways were observed for the non-outcome than the outcome. It also suggests that understanding the relationship between factors for teamwork and safety climate and error disclosure may be greater when considering what contributes to the non-disclosure of error compared to its disclosure. A similar situation can be observed when considering different workplace settings and work role. There were more cases and configurational rows present amongst nurses working in non-management roles compared to those working in a management role. However, when considering work role, it was only those who indicated their role was in management where there was a configuration noted for any of the outcome sets. One case was observed to be fully consistent with all scenarios being viewed as *Always* reported and one fully consistent for the view the severe error would *Always* be reported. These results further support the concept that teamwork and safety climate factors may be more likely to assist what leads to the non-disclosure of error rather than its disclosure.

Table 5-59 *Configurations present for outcome and non-outcome: view that error Always disclosed including workplace setting and work role*

Teamwork and safety at bedside (tf1)	Workplace relationships and communication (tf2)	Workplace safety climate (scf1)	Leadership and management of error (scf2)	Work in aged care	Work in management role	Always disclose severe error	Always disclose moderate error	Always disclose near miss error	Always disclose severe error (negated)	Always disclose moderate error (negated)	Always disclose near miss error (negated)	Work in aged care	Work in management role	Always disclose severe error	Always disclose moderate error	Always disclose near miss error	Always disclose severe error (negated)	Always disclose moderate error (negated)	Always disclose near miss error (negated)	Work in aged care	Work in management role	Always disclose severe error	Always disclose moderate error	Always disclose near miss error	Always disclose severe error (negated)	Always disclose moderate error (negated)	Always disclose near miss error (negated)	Work in aged care	Work in management role	Always disclose severe error	Always disclose moderate error	Always disclose near miss error	Always disclose severe error (negated)	Always disclose moderate error (negated)	Always disclose near miss error (negated)
1	1	1	0	1	1					7	7	0	1							1	0							0	0						
1	1	0	1	1	1	1						0	1							1	0							0	0						
1	0	1	1	1	1							0	1	1						1	0							0	0						
1	0	1	0	1	1							0	1							1	0				1	1	1	0	0						1
1	0	0	1	1	1							0	1	1	1	1				1	0							0	0					1	1
1	0	0	0	1	1							0	1							1	0							0	0					1	1
0	1	1	1	1	1							0	1							1	0						1	0	0						
0	1	1	0	1	1							0	1							1	0				4	4	4	0	0						
0	1	0	1	1	1							0	1							1	0				1	1	1	0	0						
0	1	0	0	1	1							0	1							1	0				3	3	3	0	0						
0	0	1	1	1	1							0	1							1	0							0	0						

0	0	1	0	1	1							0	1							1	0							0	0					1	1
0	0	0	1	1	1							0	1							1	0							0	0						
0	0	0	0	1	1							0	1							1	0				3	3	3	0	0					2	2

Table 5-60 *Configurational rows present for outcome that error Always reported and Always disclosed including workplace setting and work role*

Teamwork and safety at bedside (tf1)	Workplace relationships and communication (tf2)	Workplace safety climate (scf1)	Leadership and management of error (scf2)	Work in aged care	Work in management role	Always report severe error	Always report moderate error	Always report near miss error	Always disclose severe error	Always disclose moderate error	Always disclose near miss error	Work in aged care	Work in management role	Always report severe error	Always report moderate error	Always report near miss error	Always disclose severe error	Always disclose moderate error	Always disclose near miss error	Work in aged care	Work in management role	Always report severe error	Always report moderate error	Always report near miss error	Always disclose severe error	Always disclose moderate error	Always disclose near miss error	Work in aged care	Work in management role	Always report severe error	Always report moderate error	Always report near miss error	Always disclose severe error	Always disclose moderate error	Always disclose near miss error
1	1	1	1	1	1	1						0	1							1	0							0	0						
1	1	1	0	1	1	7						0	1							1	0							0	0						
1	1	0	1	1	1	1	1		1			0	1							1	0							0	0						
1	0	1	1	1	1							0	1	1			1			1	0							0	0						
1	0	0	1	1	1							0	1	1	1	1	1	1	1	1	0							0	0						
0	1	1	1	1	1							0	1							1	0	1	1					0	0						
0	1	0	1	1	1							0	1							1	0	1	1					0	0						

5.15.1 Case-based comparison views of reporting and disclosure

A comparison between the views that error would *Always* be reported and *Always* disclosed is presented in Table 5-60. This comparison also shows differences between level of harm, workplace setting and work role.

Results from this table indicate some configurational were present for just a single level of harm (such as the configurational row where all teamwork factors were positive amongst managers in aged care settings) whilst others were present for more than one. Of note is the configuration tf1*~tf2*~scf1*scf2*racf*mx which was present for all scenarios for both views of reporting and disclosure.

Differences are also present across different setting and roles. There were no configurational rows observed amongst nurses working in non-aged care clinical settings and all other configurational rows present for any outcome set were only seen in a particular setting and/or role.

It may therefore be possible that different combinations of factors of teamwork and safety climate influence outcomes in different settings and roles. What is clear from these results is that there is a level of complexity of the factors of safety climate present for the view an error may be viewed to *Always* be reported or disclosed.

5.15.2 Negated (non-outcome) sets

It was also possible compare the negated (non-outcome) sets for reporting and disclosure of error. That is, the outcome sets of interest for this comparison is the error being viewed by respondents as *Not always* reported or acknowledged to the patient/client or their family. The visual representation of this analysis is presented in Table 5-61.

Table 5-61 *Configurations present for negated (non-outcome) view that error 'Always' reported or disclosed including workplace setting and work role*

Teamwork and safety at bedside (tf1)	Workplace relationships and communication (tf2)	Workplace safety climate (scf1)	Leadership and management of error (scf2)	Work in aged care	Work in management role	Always report severe error (negated)	Always report moderate error (negated)	Always report near miss error (negated)	Always disclose severe error (negated)	Always disclose moderate error (negated)	Always disclose near miss error (negated)	Work in aged care	Work in management role	Always report severe error (negated)	Always report moderate error (negated)	Always report near miss error (negated)	Always disclose severe error (negated)	Always disclose moderate error (negated)	Always disclose near miss error (negated)	Work in aged care	Work in management role	Always report severe error (negated)	Always report moderate error (negated)	Always report near miss error (negated)	Always disclose severe error (negated)	Always disclose moderate error (negated)	Always disclose near miss error (negated)	Work in aged care	Work in management role	Always report severe error (negated)	Always report moderate error (negated)	Always report near miss error (negated)	Always disclose severe error (negated)	Always disclose moderate error (negated)	Always disclose near miss error (negated)
1	1	1	0	1	1		7	7			7	0	1							1	0							0	0						
1	0	1	0	1	1							0	1							1	0				1	1	1	0	0						1
1	0	0	1	1	1							0	1							1	0							0	0			1		1	1
1	0	0	0	1	1							0	1							1	0							0	0			1		1	1
0	1	1	1	1	1							0	1							1	0						1	0	0						
0	1	1	0	1	1							0	1							1	0				4	4	4	0	0						
0	1	0	1	1	1							0	1							1	0				1	1	1	0	0						
0	1	0	0	1	1							0	1							1	0				3	3	3	0	0						
0	0	1	0	1	1							0	1							1	0							0	0					1	1
0	0	0	1	1	1							0	1							1	0							0	0						
0	0	0	0	1	1							0	1							1	0				3	3	3	0	0			2		2	2

As with previous comparisons differences can be seen in relation to level of harm, work setting and work role. These will now be outlined.

Firstly, there is only one configurational row that is represented in relation to the view a moderate error would *Not always* be reported. This single configuration was only observed amongst nurses working in a management role in aged care this same configurational row is also present for the near miss non-outcome (negated) set, along with three others that were only present amongst nurses working in clinical roles in non-aged care settings.

This compares to numerous configurational rows observed for the outcome error would *Not always* be disclosed. In addition, no configurations were present for any of the negated (non-outcome) sets amongst nurses working in non-management roles in aged care settings.

This is in contrast to the large number of configurational rows present amongst nurses working in clinical and management roles in non-aged care settings. Apart from the aforementioned rows relating to view of the near miss negated (non-outcome) set these configurational rows relate do the view that severe error would *Not always* be disclosed. Some of these had more than one consistent case, with three configurations amongst nurses working in a clinical role in aged care settings.

Of interest is the configurational row where all teamwork and factor scores were *not positive.* Three cases consistent with this row indicated they worked in aged care clinical roles and viewed that all error scenarios would *Not always* be disclosed. A further two cases working in clinical roles in non-aged care settings, indicated they felt the near miss error would *Not always* be reported and the moderate and near miss scenario would *Not always* be disclosed.

Whilst this may suggest support for the notion that where teamwork and safety climate factors are not positive then error disclosure may not occur it is important to note that other configurational rows were present for the same outcomes where teamwork and safety climate scores were positive, including two where three of the possible four factors exhibited scores that were *positive.* Hence it is possible that similar views may occur despite high factor scores.

These results also suggest that teamwork and safety climate factor scores may contribute to understanding why disclosure does not occur more than for the outcome that error reporting does not occur. These matters will be considered further in Chapter 6 (Sections 6.2 and 6.3).

5.16 Case-based comparison all outcomes

Having considered the case-based results with comparison of the configurational rows included in the analysis for views of reporting, views of disclosure and comparison between views of reporting and views of disclosure for the outcome and non-outcome (negated set), a final comparison was made of the configurations for teamwork and safety climate for all the outcomes where fsQCA was undertaken. This comparison is condensed in Table 5-62. What can be seen from this table is that a total of 16 configurational rows are represented. Two of these (tf1*tf2*scf1*scf2*racf*mx and tf1*~tf2*scf1*~scf2*~racf*~mx) each had a case consistent with a single outcome (view that severe error *Always* reported and view that near miss error *Not always* disclosed respectively). A further six configuration rows are present for the outcome that severe error would *Always* be reported, one of which (tf1*tf2*scf1*~scf2*racf*mx) had seven consistent cases.

This configuration row with seven consistent cases is also present for four other outcomes, the view that moderate and near miss error would *Not always* be reported or disclosed. This distinct difference in outcomes is representative of the complexity of the relationship between teamwork and safety climate factors and views of reporting and disclosure of error.

Four other configurational rows have more than one consistent case. These are ~tf1*tf2*scf1*~scf2*racf*~mx with four consistent cases, and ~tf1*tf2*~scf1*~scf2*racf*~mx and ~tf1*~tf2*~scf1*~scf2*racf*~mx each with three cases (all present for negated (non-outcome) sets for view error *Not always* disclosed). The remaining configuration row with more than one consistent case is ~tf1*~tf2*~scf1*~scf2*~racf*~mx. This configuration row was present for the view near miss error would *Not always* be report and moderate and near miss error would *Not always* be disclosed.

The remaining configurational rows had one consistent case. The row tf1*~tf2*~scf1*scf2*~racf*mx is the one with the only case amongst the 85 included in the analysis with fsQCA which was fully consistent for the outcome that the error would *Always* be reported and disclosed for all error outcomes.

The row with the configuration of tf1*tf2*~scf1*scf2*racf*mx had a case consistent for the outcome that the severe and moderate error would *Always* be reported whilst the row tf1*~tf2*scf1*scf2*~racf*mx had a single case consistent with the view that the severe error outcome would *Always* be reported as well as disclosed.

The rows with configurations tf1*~tf2*scf1*~scf2*racf*~mx and ~tf1*tf2*~scf1*scf2*racf*~mx had a single case each that was consistent for the view that the severe error would *Not always* be disclosed. The latter of these cases was also consistent with the view that severe and moderate error scenarios would *Always* be reported.

Of the four remaining configurational rows with a single consistent case, three were consistent with the outcome that moderate and near miss error would *Not always* be disclosed. Of these ~tf1*~tf2*scf1*~scf2*~racf*~mx was not consistent with any other outcomes, and rows tf1*~tf2*~scf1*scf2*~racf*~mx and tf1*~tf2*~scf1*~scf2*~racf*~mx were both also consistent with the view near miss error would *Not always* be reported.

Table 5-62 *Comparison of configurations of teamwork and safety climate factors across workplace settings and work role present for more than one level of harm*

Teamwork and safety at bedside (tf1)	Workplace relationships and communication (tf2)	Workplace safety climate (scf1)	Leadership and management of error (scf2)	Work in aged care	Work in management role	Always report severe error	Always report moderate error	Always report near miss error	Always report severe error (negated)	Always report moderate error (negated)	Always report near miss error (negated)	Always disclose severe error	Always disclose moderate error	Always disclose near miss error	Always disclose severe error (negated)	Always disclose moderate error (negated)	Always disclose near miss error (negated)
1	1	1	1	1	1	1											
1	1	1	0	1	1	7				7	7					7	7
1	1	0	1	1	1	1	1										
1	0	1	1	0	1	1						1					
1	0	1	0	1	0										1	1	1
1	0	1	0	0	0												1
1	0	0	1	0	1	1	1	1				1	1	1			
1	0	0	1	0	0						1					1	1
1	0	0	0	0	0						1					1	1
0	1	1	1	1	0	1	1										1
0	1	1	0	1	0										4	4	4
0	1	0	1	1	0	1	1								1	1	1
0	1	0	0	1	0										3	3	3
0	0	1	0	0	0											1	1
0	0	0	0	1	0										3	3	3
0	0	0	0	0	0						2					2	2

The case for the remaining row ~tf1*tf2*scf1*scf2*racf*~mx was consistent for the view that near miss error would *Not always* be reported and that severe and moderate error would *Always* be reported.

Of the eleven outcomes represented in this table, all but four had more than one configurational row present for the relevant outcome (or non-outcome). This indicates a degree of equifinality amongst the different solutions for each outcome. Diversity is also present.

This, along with several of configuration rows containing a case (or cases) consistent with the outcome for one level of harm and the non-outcome for another level suggests a level of complexity exists in the relationship between teamwork and safety climate factors and views of reporting and disclosure of error. In the very least, the relationship is asymmetrical.

5.17 Summary of case-based results

Several analyses using *fsQCA* were undertaken for this research. Utilising the four factors determined from PCA as conditions with the outcome determined as views of reporting or disclosure, a comparative analysis was undertaken with *fsQCA.* Whilst an initial analysis found configurations present for the outcome relating to views of error reporting and disclosure the different levels of sufficiency cut-off would have made comparison difficult and therefore only the results relating to what nurses thought was happening in relation to the reporting of the severe error scenario was discussed in detail. The remaining results were included as appendices..

The addition of demographic data as to whether respondents worked in residential aged care (or not) and if they worked in a management role (or not) were added as crisp sets. This resolved many of the contradictory rows that were present in the truth tables, some of which were analysed with fsQCA were produced of conditions and views error would *Always* be reported or disclosure for each level of harm as well as the negated or non-outcome. The resolution of the contradictory rows resulted in the ability to set a sufficiency cut-off of 1.00 for all analyses which allowed for comparison between the results of these different outcomes..

In all instances where analyses were undertaken there were solution terms containing more than one factor for the outcome under consideration. Thus *conjunctural causality* (more than on condition present for the outcome) was observed For most of these outcomes *equifinality* was also observed. That is, there was more than one set of configurations observed to be present for the relative outcome.

Some configurational rows that were observed to be present for the negated outcome were also present for the outcome of the other error scenarios. This suggests complexity and indicates the relationship between teamwork and safety climate factors and views of reporting and disclosure of error is not symmetrical. ..

A further result to note is that the presence of all positive factor scores was only present for the outcome in the initial analysis of conditions. When analysis was undertaken with additional demographic conditions that particular configuration was only present in one case which was manager working in aged care settings.. There were configurational rows present for the same outcome that included factors that were not positive, including one which covered seven cases (managers working in an aged care setting). Thus, it is possible that error will still be viewed as reported (or disclosed) even if some factor scores are *not positive.*

What emerged from this comparison of multiple outcomes was that the solution terms for views of reporting severe error and those for the views for the non-outcome (negated set) had greater coverage when compared to those observed for the outcome moderate and near miss error would be reported and all error scenarios would *Always* be disclosed. The solution terms, solution paths and cases with higher levels of coverage therefore had greater membership within the outcome set.

This suggests that there may be a stronger relationship between the results of teamwork and safety climate factors and those particular outcome sets. This may also indicate that the use of the SAQ is more able to identify relationships that could assist understanding why moderate and near miss error is not reported and why all scenarios were not disclosed.

5.18 Chapter summary

Results of both variable and case-based analyses have been presented in this chapter. The first of these identified differences in relation to views of reporting and disclosure and also safety climate. The differences were found between views of reporting compared to disclosure as well as workplace setting and work role. Variable results also suggest a possible relationship between some positive teamwork and safety climate factor scores and views of reporting and disclosure.

The case-based results found differences in the configurations that were present for each of the views of reporting and disclosure. These differences were observed when comparing views of reporting with views of disclosure, different levels of severity of harm as well as workplace setting and work role.

Having established the presence of configurations is not a finding in itself. It should not be assumed that these configurations are causal for the particular outcome for which they have been found.

What the comparative results do indicate is that there is possibly a stronger relationship between the solution terms, solution paths and cases for the outcome that severe error would *Always* be reported and that severe, moderate and near miss error would *Not always* be disclosed. That is, apart from views of reporting severe error, we possibly understand more how safety climate and teamwork influences why error is not reported and disclosed rather than why it is. This matter will be explored further in the following chapter.

The final phase of analysis is to consider the findings with regard to case and theoretical knowledge. This occurs in the *after the analytical moment* phase and will be undertaken in the next chapter.

6 Discussion

The nature of error management in health care is complex. Although error reporting is an important part of error management it is an approach that results in a focus on the measurement of the non-presence of safety. To ensure safety is present a greater focus on *resilience* is required. For *resilience* to be understood it is necessary to accept the complexity of the health care system and adopt innovative methods for researching that complexity. Understanding *resilience* may assist in understanding how to achieve safe patient care.

The aim of this research is to *describe the complexity of safety climate of nurses working in rural clinical settings.* The research question that was established to achieve this aim was: *how is safety climate related to views of reporting and disclosure of medication error amongst nurses working in rural clinical settings?* As outlined in the literature review this aim assumes that this relationship is complex (Section 2.19.1).

Five research sub-questions were also developed to inform the research question and aim. These are:

1. *What level of reporting and disclosure of different severity of a hypothetical medication error do nurses in rural clinical settings think is occurring?*

2. *What is the nature of workplace safety climate amongst nurses in these settings?*

3. *What is the relationship between workplace safety climate amongst nurses in rural clinical settings and their views of reporting/disclosure of a hypothetical medication error?*

4. *How is the understanding of the relationship between workplace safety climate and views of reporting medication error changed through the use of a configurational comparative method?*

5. *What does this mean for the management of medication error?*

Results relating to each of these sub-questions inform the findings that will be presented in this chapter. The first two relate to the specific areas of data collection for the *outcomes* (views of reporting and disclosure relating to different levels of harm) and *conditions* (scores for factors of teamwork and safety climate) determined for this research. The third ensures examination of the relationship between each of these.

The fourth and fifth sub-questions are informed through the use of CCM within a framework of health care as a complex system (Martin & Félix-Bortolotti, 2010). Through this approach it has been possible to describe the complexity of safety climate and views of error reporting and disclosure and thus achieve the aim of this research.

The final phase of the *funnel of complexity* is *after the analytical moment* whereby consideration is given to how the results inform existing knowledge of case, context and theory knowledge (Rihoux & Lobe, 2009). Through the use of CCM to address the research question and sub-questions and therefore achieve the aim of this research, three key findings have emerged. These three findings relate to complexity in rural clinical settings, the implications for resilience and reframing the management of medication error.

The first finding refers to the contribution this research makes to knowledge regarding complexity of safety climate and error reporting and disclosure in rural clinical settings. This research identified differences between views of reporting compared to disclosure, severity of harm, workplace setting and work role. These reflect results from other studies and suggest similarities between the views of nurses in rural clinical settings and nurses and other health professionals in other areas of health care.

The second key finding relates to implications for *resilience* which is informed by the concept of *Safety I* and *Safety II.* This finding was determined through analysis utilising both variable and case-based results within a framework of different approaches to knowledge generation in a complex health system (Martin & Félix-Bortolotti, 2010).

Firstly, the inferential statistics indicated that nurses working in aged care settings were more likely to view error to be reported or disclosed. This suggests they are *resilient* with respect to reporting and disclosure and that further investigation is warranted into why this result has occurred. Secondly, the comparison of the case-based results suggests that the solution terms, solution paths and cases have greater membership in relation to the outcome a severe error would *Always* be reported and severe, moderate and near miss error would *Not always* be disclosed. That is, knowledge linking teamwork with what goes wrong *(Safety I)* are greater than what goes right (*Safety II*).

This research used a framework for complexity in health care (Martin & Félix-Bortolotti, 2010). The successful application of this framework was possible through two means. Firstly, the use of a transparent process for the case-based analysis allowed for a comparison of multiple outcomes and secondly the use of both variable and case-based results made use of both *evidence* and *sense-making.* This allowed for interpretation of the results that makes theoretical sense.

Both of these findings support the need to reframe the management of medication error. This key finding suggests that the two approaches to safety (*Safety I* and *Safety II*) (Hollnagel, 2014) have a role in improving medication management allowing for safe patient care to be achieved. Rather than regarding safety climate as an intervention to improve error management, error management needs to be reframed as an action required for safe patient care. However, if we are understand how this is to be achieved, a greater knowledge of how safety climate influences the actions that lead to error being reported and disclosed is required rather than how they may hinder them. That is, Hollnagel's argument of a *Safety II* approach needs to be adopted in both practice and research.

These findings will now be discussed in more detail. Following this, the limitations of this research will be outlined. The chapter concludes with discussion of future directions for research.

6.1 Complexity in rural clinical settings

The first three sub-questions of this research have assisted in describing the complexity of safety climate amongst nurses in rural clinical settings. Through examination of how safety climate is related to views of reporting and disclosure of medication error amongst nurses working in rural clinical settings it was found that there are similarities between results obtained from this research and those of previous studies.

Differences were noted between views of reporting compared to disclosure as well as with regards to the severity of harm resulting from a given error (Section 5.4). Some safety climate factor scores were also more likely to be positive in relation to views of reporting and disclosure (Sections 5.9.1 and 0).

Differences have been found in other studies between views of reporting and views of disclosure. This includes emergency department personnel (Hobgood, Bowen et al., 2006; Hobgood, Weiner et al., 2006) and acute hospital settings including intensive care units (Latif et al., 2013).

Other studies have also identified that error is more likely to be reported if harm is involved compared to when there is no harm (Kagan & Barnoy, 2008). A study in the US of hospital leaders found that the frequency of views an error would be reported or acknowledged decreased as harm decreased (Weissman et al., 2005). This same study also found lower frequency for disclosure compared to views an error would be reported.

Workplace settings and work role were further areas of differentiation (Sections 5.7.1 and 5.7.2). In particular, aged care nurses were more likely to view that an error was reported or disclosed and those working in a management role more likely to view error was disclosed compared to clinicians.

It is difficult to determine a specific reason for this. Whilst it has been suggested that cognitive impairment of a resident/client may improve disclosure of error by nurses in aged care settings it is not possible to make that assumption from the results obtained here (Wagner et al., 2013).

The definition of the term *disclosure* for this research differs to that of *open disclosure.* It is difficult to determine if this is a factor in the current study as the survey question, whilst asking about likelihood of acknowledgement did not seek further details about how much information would be disclosed, nor did it refer to any form of apology. However, neither of these elements is possible without an initial acknowledgment.

In addition, the different approaches to accreditation that are in place in Australia (Hinchliffe et al. 2012) may be a further explanation, although further research would be required to determine this. For example, it has already been highlighted in Chapter 2 that accreditation of general practice, hospitals and aged care facilities is overseen by different agencies and they are also governed by different legislation (Hinchliffe et al. 2012). This may be an area where further research identifies areas of difference.

A recent publication (Greenfield et al., 2015) has highlighted that accreditation programmes in Australia reflect models of continued quality improvement and regulatory compliance with a hybrid mode encompassing each of these being adopted. It may be that differences exist between the accreditation agencies as to the extent to which the hybrid model reflects improvement and compliance. There may also be differences in relation to the oversight that the agencies have and the level at which facilities are assessed.

It has previously been postulated that acute hospital staff are more likely to witness error so they have a lower view of safety in their workplace (Vlayen et al., 2011). However, in the present study there was only one factor from four where a difference was noted amongst workplace settings indicating if the postulated view is correct the only difference would be in relation to *workplace safety culture.* It is not possible to determine from this research why a difference was found with only one factor. Although the difference between the hospital and non-hospital environment has been identified it has not been explained. Workplace settings, including different contexts, as well as experience and education are all areas worthy of consideration for future research.

Further differences were found in the frequency of views of disclosure of the error amongst nurses in different work roles, with nurses who indicated that they worked in a management role more likely to view the error would *Always* be acknowledged. However, there were no differences found based upon level of registration or between managers and clinicians in relation to the view the error would *Always* be reported formally in their workplace. This is in contrast to findings of other studies which have found senior nurses have indicated they reported error more frequently compared to the clinical (staff) nurses (Kim et al., 2007; Kagan & Barnoy, 2013). This reflects the complex nature of safety climate and views of reporting and disclosure.

It has also been noted by others that there are gaps between what managers consider they would report in relation to their actions compared to what is actually happening in practice where it is found that actual reporting rates are lower (Westbrook et al., 2015). It is therefore possible that the actual reporting rates amongst settings in this current study are lower than those that nurses consider are occurring. This is an important point to note as one may be tempted to argue that views of what is occurring is lower than reality yet the abovementioned study suggests otherwise.

Safety climate factors were also found to differ. Positive scores were more likely to be found in some workplace settings and amongst different work roles (Sections 5.3.2 and 5.3.4). A further point of note here is that although, as noted in Chapter 2, safety climate may influence safety culture (as well as the reverse) (Morello et al. 2013) this present research examined safety climate only. Therefore results make reference to safety climate only.

To extend the results of this research beyond this is therefore not possible. Not only because of the nature of the data obtained through use of the SAQ, but because of the difficulty in determining what *culture* is.

As highlighted in Chapter 2 (Section 2.15) there is no consensus regarding a definition nor is there agreement as to whether the terms *safety climate* and *safety culture* are related (Halligan et al., 2011). Therefore, whilst in this research *safety climate* has been situated within the broader concept of *safety culture* (Section 2.15) there are many who may disagree with this approach.

In relation to this the use of the term *workplace safety culture* as a term for one of the factors, this should be seen in terms of the items of the SAQ which form that factor. That is, the term relates only to *items 15, 16, 17* and *19* as viewed by the individual participants rather than an assessment of workplace safety culture overall. Further consideration of this issue will be given in Section 6.3.4 of this chapter.

This research identified that with respect to workplace setting a positive factor score for *workplace safety culture* was more likely to occur amongst nurses working in community and aged care settings compared with nurses in rural hospital/multipurpose settings. This reflects results of other studies where safety climate was found to be higher in roles outside of acute care settings (Braithwaite et al., 2009; Deilkas & Hofoss, 2008; El-Jardali, Jaafar, Dimassi, Jamal, & Hamdan, 2010; Verbakel et al., 2014; Vlayen et al., 2011).

Those working in management roles were also more likely to have a positive factor score for *teamwork and safety at bedside, workplace safety culture* and *leadership and error management.* These results reflect other studies where those in management roles were found to have higher safety climate scores (Braithwaite et al., 2009; Singer et al., 2003; Vlayen et al., 2011).

Results from the principal components analysis also found subtle differences between this research and a previous study (Hutchinson et al., 2006) (Section 5.6). The internal consistency of a factor structure established by a previous study in the UK was not achieved (Hutchinson et al., 2006). Subsequent exploratory principal components analysis found some differences in the number and make-up of factors based on the data obtained in this study compared to the results of the UK study. It is possible that differences in context or work role may explain this result.

This point regarding different context and work role may be expanded through consideration that the present research involved only nurses whereas the UK study included responses from both medical and nursing staff in the analysis (Hutchinson et al., 2006). This suggests work role may have an impact upon teamwork and safety climate.

The results of the present research also included responses from staff working away from direct patient care whereas the UK study did not include these as to do so would impact upon reliability. This is a further example of how work role may have an impact.

In addition, it may be that Australian nurses in management roles, particularly those working in small worksites are closer to direct patient care than their UK counterparts. In this respect not only work role but the context of small rural hospitals may have an impact upon safety climate. This is another area for potential further research that will be discussed later in this chapter.

Facility size and regional areas were further areas of difference (Sections 5.8.4 and 5.8.2). Although there is another examples of different safety climate found based upon facility size (El-Jardali et al., 2010), the results relating regional location of the workplace may have been influenced by a higher number of responses from nurses in aged care settings. Although not conclusive, these areas are worthy of consideration for in future research.

Other studies have found differences in views of reporting and/or disclosure based upon experience. The low number of responses for this research restricted analysis in this area therefore a clear finding is not possible.

Despite other studies finding differences in safety climate based upon nursing experience (Chiang et al., 2010; Kim et al., 2007) the low response rate affected the ability to conduct this analysis for the present study. Nor was any difference noted based upon level of registration.

Feedback has been highlighted as a facilitating factor (Hartnell et al., 2012). If results with regard to performance feedback obtained in the current study (Section 5.5) reflect similar practices in feedback from error reporting then this is an area for potential concern and may indicate another area of future research.

Approximately one in five of the nurses who responded to this study indicated they disagreed with the statement they received appropriate feedback regarding their performance. This suggests the facilitating factor of feedback that was identified by Harntell et al. (2012) may be lacking amongst the respondents to this study. Whether or not this is limited to the responses of this study or goes further afield warrants further investigation. Research as to whether or not this element is also impacting upon error reporting and disclosure is also worth considering.Lack of training has also been identified as a barrier to error disclosure along with fear, blame and punitive culture (Harrison et al., 2014). Although not a consideration in the current study, others have noted differences in relation to training and education. Academic nurses have been found to have higher rates of error but lower reporting rates (Kagan & Barnoy, 2008) and education has also been linked to improving medication error reporting along with improving communication and ensuring reporting is not burdensome (Hartnell et al., 2012). The importance of training as preparation for involvement in open disclosure has also been recognised elsewhere (Iedema et al., 2008).

Other problems identified, such as nurses not being involved in the disclosure process (Harrison et al., 2014) may assist in explaining some of the differences in the results of the current study. Aged care nurses may be more involved in the process of disclosure and may have more education in relation to it. A study in aged care setting supports this, with RN's with more education and having had prior experience of error disclosure being more likely to provide more information about an error to nursing home residents (Wagner et al., 2013). This is a possible area for future research that will be discussed further later in this chapter.

Results considered to this point have therefore reflected the complexity of views of reporting and disclosure as well as safety climate amongst nurses in rural clinical settings. They relate to the first two research sub-questions which are:

1. *What level of reporting and disclosure of different severity of a hypothetical medication error do nurses in rural clinical settings think is occurring?*
2. *What is the nature of workplace safety climate amongst nurses in these settings?*

Implications arise in relation to what has been discussed so far. These will now be addressed prior to further consideration of the complexity of rural clinical settings.

6.1.1 Implications

Several implications should be noted with regards to the first finding relating to the complexity of rural clinical settings. These include further discussion regarding the non-disclosure of the near miss error and *positive deviance*

For both reporting and disclosure of the near miss outcome the frequency of respondents in this research was lower than the moderate and severe outcomes, each of which involved harm. Two issues arise from this. Firstly, the perceived impact of the law upon reporting and disclosure and secondly the importance of near miss error and safe medication management.

One of the reasons given for non-reporting and/or non-disclosure of error is a fear of reprimand or fear of litigation (Haw et al., 2014; Studdert & Richardson, 2010). It is therefore difficult to explain why the scenario where there is no harm is so low in frequency of respondents indicating it would *Always* be reported or disclosed. Whilst mandatory reporting may explain why severe error is viewed as *Always* reported litigation for negligence involves a process which includes the involvement of harm (Atkins et al., 2014). It is therefore arguable that a near miss error with no harm involved has extremely low risk of litigation.

This suggests there may be other factors involved in addition to fear of litigation. One study in the chemical industry found that workers exposed to near miss error did not consider it to be an error as they had intervened and there was no resulting harm (Kanse, 2004). Similar results have been found in a recent study of nurses and error where near miss error on the whole went unreported (Hewitt & Chreim, 2015).

Studies acknowledging the under-reporting of error, including near miss error are well documented. Work burden, lack of knowledge and excusing the error were identified in one study (Haw et al., 2014) and blaming the individual rather than adopting a systems approach have been acknowledged elsewhere (Bayazidi et al., 2012). Many of these elements were noted in the *To Err is Human* report (Kohn et al., 2000). However, it is of concern that despite this report studies some ten to fifteen years later are still determining why error is not reported. It is arguable that there is a need for greater focus upon why such errors are reported and disclosed (*Safety II*) rather than continue to investigate why they are not (*Safety I).* This is an area of potential future research that will be explored further in Section 6.6 of this chapter.

Identification that aged care nurses are more likely to both report and disclose error is important (Sections 0 and 0). It is important that the consumer or patient is involved in medication management (Australian Commission for Safety and Quality in Health Care, 2013b) and there is a suggestion from this research that such involvement may be limited in hospital and community settings.

In addition, having obtained data from a range of rural workplace settings, including the aged care and community contexts supports the view that context should be considered in disclosure research (Birks et al., 2014). If, like many other studies, data had only been obtained from secondary care settings then this finding would not have been made.

As indicated in the literature review, there are arguments that a greater focus needs to be placed upon what is required for things to go right in the delivery of health care (Hollnagel, 2014) (Section 2.6). This includes focusing upon those areas which exhibit a *positive deviance* and are therefore likely to be resilient (Lawton et al., 2014).

The views of aged care nurses suggest that there may be something to be learned through further research regarding their views of reporting and disclosure. It is this possible *positive deviance* that led to the condition of residential aged care (or not) being added for *fsQCA* analysis. Similarly, the difference between nurses working in management roles compared to those working in a clinical role resulted in adding the further condition of management (or not management). Further discussion in relation to this will be undertaken at a later stage when considering the case-based results from this research (Section 6.2.1).

The variable-based results of this research found differences relating to workplace setting and work role as well as between different levels of harm and reporting and disclosure of the same level of harm. However these findings do not explain how any of these differences arise.

Findings from this present research and that of others indicates the differences in safety climate and teamwork are not consistent from one setting to the next, one role to the next or one context to the next. That is, although differences have been identified, there is no single variable that influences either views of reporting and disclosure or safety climate in a consistent fashion.

In other words, the *simple/complicated* approach to research has not provided understanding of how the factors of teamwork and safety climate are different based upon workplace setting or work role. Nor can such an approach explain the difference in findings from this research compared to other studies. Differences have been identified but cannot be explained.

6.2 Complexity between workplace safety climate and views in rural clinical settings

Having established the level of error that nurses think is being reported as well as the nature of safety climate amongst nurses in rural clinical settings, it is now possible to consider the third research sub-question: *what is the relationship between workplace* *safety climate amongst nurses in rural clinical settings and their views of reporting/disclosure of a hypothetical medication error?* This was achieved through both a variable-based analysis making use of inferential statistics and case-based analysis using *fsQCA.*

The variable results suggest a relationship exists between some factors of teamwork and safety climate and views of error reporting and disclosure. Respondents with positive scores for *teamwork and safety at bedside* and *leadership and error management* were more likely to view the severe error scenario to be reported and all error scenarios to be acknowledged to the patient and/or their family. In addition, the moderate outcome scenario was more likely to be disclosed if the factor for *workplace safety culture* was positive. These results reinforce findings from other studies where a no-blame, non-punitive approach is considered to improve the rate of error reporting and disclosure (Duffy, 2012; Kim et al., 2007; Kronman et al., 2012).

Although a link between safety climate and the occurrence of medication error has been suggested (Colla et al., 2005), a recent review and pilot meta-analysis found no relationship between these two variables (Groves, 2014). Whether the same result would be obtained in a meta-analysis of research relating to views of reporting rather than actual error occurring result is unclear. This suggests that further research may be needed.

An example of how large N studies may obscure significant results at the more micro level was provided in the literature review (Townsend, 2013). Systematic reviews rely on meta-analysis (Evidence-Based Medicine Working Group, 1992) through combining samples. Therefore, such an analysis may also obscure details relating to differences based upon context. Although a systematic review has suggested no established relationship between safety climate and medication error it is also plausible that there may be a genuine relationship existing within the context of this research.

The variable-based results have therefore identified the possibility a relationship may exist between some factors of safety climate and views of reporting and disclosure. As with previous results, this relationship has been identified but the differences cannot be explained.

Consideration of the case-based results provides further support that this relationship may exist. These results will now be discussed.

6.2.1 Case-based results

An extensive case-based analysis was undertaken for this research using *fsQCA,* a configurational comparative method. Rather than adopting a *simple/complicated* approach to research, this method of analysis allowed for the recognition of complexity (Martin & Félix-Bortolotti, 2010).

The initial case-based analysis, which included only teamwork and safety climate factors as conditions, establishes a possible relationship may exist with regards to views of reporting and disclosure of error. Due to a large number of contradictory cases the sufficiency cut-off for each varied. Thus, only the outcome related to reporting of severe error was fully reported in this research and the remaining analyses can be found in Appendix 1. These analyses suggested there may be a relationship between safety climate and views of reporting and disclosure. However, with the different sufficiency cut-off values a comparison of multiple outcomes would have been difficult so the option of adding further conditions was explored..

This further case-based analysis was therefore undertaken through adding conditions for workplace setting and work role. This resulted in configurational rows with a consistency of 1.00 and so analysis of multiple outcomes possible. This analysis allowed for comparison of the results and the configurational rows between the different outcome sets.

This comparison identified differences in the presence of configurations. These occurred in areas similar to those identified through the variable-based analysis, including between views of reporting and disclosure, severity of harm, workplace setting and work role.

These patterns amongst the configurations suggest a possible relationship between safety climate and views of reporting and disclosure. Underpinning this is a large degree of complexity.

Assumptions regarding the presence of positive safety climate (Duffy, 2012; Kim et al., 2007; Kronman et al., 2012) are also challenged in this analysis including additional conditions. The configuration where all factors are positive was only present in aged care settings, although not for all outcomes.

There were also other configurations that were present where a factor score (or scores) was *not positive*. This suggests the relationship between factors and outcomes is not a single solution and this challenges existing assumptions around the need for positive safety climate to improve error reporting and disclosure (Duffy, 2012; Kim et al., 2007; Kronman et al., 2012; Etchegaray & Thomas, 2012; Hutchinson et al. 2009).

The configuration where all factors were *not positive* was present amongst nurses working in clinical roles in aged care settings who held the view that near miss error would *Not always* be reported and moderate and near miss error *Not always* disclosed. This also challenges the view that if a safety climate and teamwork factor is *not positive* then it is unlikely that an error would be e likely to be reported or disclosed.

With no other known studies using a configurational comparative method in this subject area it is not possible to make a direct comparison. There are, however, similarities between these results and those of other studies where CCM has found more than one solution for an outcome.

As noted in the literature review, a study of transformational leadership found that leaders with this trait were able to implement organisational change (Whittington & Goodwin, 2013). However, this study also found combinations of other elements that, if present, could result in the same outcome.

Another study looking at smoking cessation found that education was not the sole factor for success in low socio-economic communities but that access to housing and employment opportunities were also required (Blackman, 2008). In each of these studies the use of CCM allowed for the identification of causal complexity that challenged existing assumptions. These results mirror those of this research where additional explanations for an outcome may have been identified.

This research therefore addresses the third research sub-question through the use of variable and case-based results. The former has identified that some positive factor scores lead to a greater likelihood that some error outcomes are more likely to be viewed as reported or disclosed. This reflects the findings of other research.

However, the case-based results have also added to these. With some configurations present for the outcome in some settings and roles also found to be present for the negated (non-outcome) for near miss disclosure suggests the relationship between factors of safety climate and views of reporting and disclosure is complex.

This complexity is further indicated when considering the results comparing solution coverage of the solution terms for each outcome. Those with the greatest number of cases and solution coverage (that is the greatest membership in the outcome set) were in relation to views that severe error would *Always* be reported and all levels of harm would *Not always* be disclosed. This suggests more may be known about what elements of safety climate hinder error reporting and disclosure than what promotes it. The exception is reporting of severe error. However, this may reflect the focus of public enquiries such as those noted in Chapter 2. This is explored further in Section 6.4

The presence of configurations for the outcomes is not a finding in itself (Schneider & Wagemann, 2012). Nor has it been ascertained that the configurations are causal. All that has been established to this point is that there is complexity regarding them. However, in contrast to the variable results which have identified differences, the case-based results provide an opportunity to explain these differences and to inform future research. In particular, there are implications regarding the concept of *resilience* and the need focus more upon *Safety II* (what supports error reporting and disclosure) rather continue to focus primarily upon *Safety I* (identifying what hinders it). In order to make further sense of the results it is necessary to return to the theory that informed this research.

6.3 Implications for resilience and error management

The final phase of analysis occurs in the *after the analytical moment* phase where results are considered with regards to case and theoretical knowledge and this still needs to occur (Rihoux & Lobe, 2009; Schneider & Wagemann, 2010). This final phase produced a second key finding of this research regarding an emerging resilience in relation to safety climate.

Consideration of different approaches to theory development and error management informed this finding which was possible through a *retroductive* analysis of both the variable and case-based results. Details of this finding will now be discussed further.

6.3.1 Different approaches to developing theory

The use of CCM for this research served two main purposes which were outlined in Chapter 3**.** Firstly, as the research aim was to *describe the complexity of safety climate of nurses working in rural clinical settings* the purpose of CCM was to summarise the data in manner that would describe the complexity of safety climate. The second purpose of using CCM was for theory development.

Both *deductive* and *inductive* approaches to theory development were discussed in Chapter 3 (Section 3.4). It was noted that *retroductive* theory development occurs with CCM analysis (Ragin & Amoroso, 2011).

In addition, the need to focus on *effectality* was explained (Section 3.6.1) (Byrne, 2011). That is, it is important to focus on the outcome and what is required for it to occur rather than causality. To this point discussion for this finding regarding *resilience* has drawn on both *deductive* and *inductive* approaches. This will now be further clarified.

The aim of this research is based upon an underlying assumption of the existence of complexity. This was noted in the literature review (Section 2.19.1).

The variable-based results of this research, through finding that there is similar complexity amongst rural clinical nurses, whilst not strictly testing a hypothesis, supports this underlying assumption of complexity. In this sense, the finding is a *deductive* one.

The previous section of this chapter also outlined differences found in the configurations present for each outcome of interest. This provides a description of the complexity of the relationship between factors of teamwork and safety climate and views of reporting and disclosure of error.

These results could be interpreted as *conjunctural causality* (Ragin, 1987; Schneider & Wagemann, 2012). That is, numerous configurations were found for each outcome and therefore it could be interpreted that each configuration is causal for the particular outcome of interest. However, if such causality exists then there must be other elements contributing to that causality.

The configurational rows present for views of reporting and disclosure, different severity of harm, workplace setting or work role were different. This also supports the notion of complexity.

To suggest the configurations are causal is using the results of this research to inform theory. That is, the process is more an example of *inductive* interpretation.

Such an interpretation is somewhat limited. To do so considers the case-based results in isolation from the variable-based results with no reference to theoretical knowledge. This is in contradiction of the aims and recommendations for good practice when using CCM (Schneider & Wagemann, 2010). Through approaching the interpretation of results through reference to theory, an alternative explanation is proposed that makes theoretical sense.

The relevant theory that is drawn upon is related to the different approaches to error management which will now be discussed. Consideration of the variable-based results is also required as part of this process.

6.3.2 The complexity of error management

Different approaches to error management were outlined in Chapter 2 (Hollnagel, 2014). In particular the difference between *Safety I* and *Safety II* was outlined. The first of these focuses on what has gone wrong to cause an error whereas the latter focuses on understanding what is required for things to be done safely. This leads to the need to understand how some organisations achieve this consistently and become *resilient* (Hollnagel, 2014).

Each of these will now be explored with regard to the error scenario used for this research. From doing so it is possible to interpret both the variable-based and case-based research with respect to current theoretical knowledge.

The error scenario used for this research involved the prescribing of an antibiotic for an infection where there was a known documented allergy (Weissman et al., 2005). From a *Safety I* perspective the error would be described as a prescribing error (Australian Commission for Safety and Quality in Health Care, 2013b). This interpretation places the focus upon what has caused the error.

If such an error causes harm it is an *adverse event* (Australian Commission for Safety and Quality in Health Care, 2013a). In such cases the error should be both reported and disclosed. Results from this study and others suggest that if the error is severe it is much more likely to be both reported and disclosed (Basey et al., 2013; Sheu et al., 2009; Weissman et al., 2005). Therefore the focus is upon harm.

By contrast, the outcome of the near miss scenario used in this research resulted in no harm to the consumer/patient. However, such events should still be reported so as to assist prevention of further errors of the same nature. Based upon the results of this study and others it is reasonable to assume that such errors are much less likely to be either reported or disclosed (Basey et al., 2013; Sheu et al., 2009; Weissman et al., 2005). Yet, near miss errors occur more often than adverse events (Westbrook et al., 2015). A learning opportunity is missed through not examining these events, particularly as there may be clues to the prevention of further harm.

The non-disclosure of the near miss scenario has ramifications for safe medication management. The ACSQHC also has guidelines for best possible medication assessment including the appropriate documentation of allergies which is also required by *Standard 4* of hospital accreditation (Australian Commission for Safety and Quality in Health Care, 2011a). In the literature review it was noted that patient involvement is an area highlighted for improvement (Australian Commission for Safety and Quality in Health Care, 2013b). The patient or consumer is regarded as the last point at which an error may be prevented (Elliott & Liu, 2010).

If a patient or consumer is administered a medication that they are supposed to be allergic to and after two days has no reaction then the question should be asked as to the accuracy of the history and documentation of the allergy. It is therefore possible to argue that rather than simply alter the medication prescribed (as in the scenario) there should be a conversation with the consumer regarding this matter. Although *open disclosure* is not necessary as there is no harm, the acknowledgment of the error needs to occur to ensure safe medication management is achieved. To not undertake this process arguably puts the consumer at future risk.

The *Safety I* approach is therefore a necessary element of error management. Indeed, it could be argued that a *Safety II* approach to *Safety I* is required. That is, what should happen when an error occurs is that it should be reported and disclosed. Not because it needs to be measured, but because to do so reflects the aim of achieving safe patient care. This will be examined further in Section 6.4.

The *Safety II* approach argues for a greater focus on understanding what is required for things to be done safely which then leads to the need to understand how some organisations achieve this consistently and become *resilient* (Hollnagel, 2014). In this respect, consideration would be given to ensuring the error is acknowledged to the patient so they may be involved in the management of their medications.

Therefore, there is a need for a greater focus upon what is needed to support the reporting and disclosure of error. Further consideration of the results will now be undertaken in respect of this.

6.3.3 Results interpretation

Each of the theories noted above may now be drawn upon to in order to inform the findings of this research, in particular the finding relating to the implications for *resilience*. Both the variable and case-based results need to be examined. In doing so, it is possible to address the main aim of this research and *describe the complexity of safety climate of nurses working in rural clinical settings* through interpretation of the results.

The variable-based results identified the complexity that exists between safety climate and views of error reporting and disclosure. In particular, aged care nurses were more likely to view error to be reported or disclosed and those working in management roles more likely to view it disclosed. However, it was also noted that nurses in non-management roles in aged care were more likely to view error reported or disclosed.

The situation whereby safe outcomes are consistently achieved by some people or organisations is referred to as *positive deviance* and it is argued that a greater focus on those who achieve this is required (Lawton et al., 2014). This was outlined in Chapter 2.

It has been noted that aged care nurses and those in a management role may represent *positive deviants* (Section 3.3). The likelihood an error would be viewed as reported or disclosed differed between reporting and disclosure as well as decreased in conjunction with decreased severity of harm (Section 5.7).

The case-based results found differences in configurations present in relation to each of these matters. While it is possible there may be an element of *conjunctural causality* (that is, the configurational rows are causal for the relative outcome) (Ragin, 1987; Schneider & Wagemann, 2012) there is also *equifinality* (more than one solution pathway present for any outcome) as well as other patterns present when making comparison across the multiple outcomes. If reference is made to solution coverage values, there is a pattern suggesting a stronger relationship may exist between teamwork and safety climate factors and certain outcomes As well as the presence of some configurations for more than one outcome there were some configurational rows found to be present for both the outcome the error would *Always* be reported or disclosed as well as for the negated (non-outcome) for reporting and/or disclosure of the same outcome in a different setting and/or role. This demonstrates further complexity and also highlights the importance of the analysis of the occurrence of the non-outcome set. It also highlights that if there is *conjunctural causality* or *equifinality* it is not consistent across all workplace settings or work roles.

Through examination of the variable and case-based results and consideration of the theoretical knowledge it is possible to postulate that the different configurations are an indication of the presence, or absence, of *resilience* (Hollnagel, 2014). For example, of the 85 cases included in the case-based analysis there was just one that was consistent for the solution terms of all outcomes where error was viewed as *Always* reported and disclosed. It is cases such as this that offer opportunity to discover what is needed in to support the reporting and disclosure of error. In doing so a *Safety II* approach is being undertaken. Cases such as this therefore offer an opportunity to identify *resilience* and therefore inform improvement research.

Of note is that this particular case exhibited the conditions tf1*~tf2*~scf1*scf2 and worked in a management role in a non-aged care setting. Whilst this response indicated a teamwork and safety climate factor that were *not positive* suggesting that not all factors need to be positive for a view that an error is *Always* reported or disclosed it could also be argued that the respondent's role as a manager may have also influenced the result in some way. However, until such cases are identified and examined further such statements are merely postulation. Either way, this case is unique amongst those considered in this research and if data were re-identifiable would offer an opportunity not possible through other methods. That is, case-based fsQCA has allowed for the identification of an unusual case that could assist understanding about how elements of teamwork and safety climate may promote the reporting and disclosure of error.

Conversely, several cases were consistent for solution terms relating to only the negated (non-outcome) set and yet other cases were consistent outcomes in a combination across both. These differences may suggest a phase shift is occurring in relation to safety climate and views of reporting and disclosure. However, whether this is in reference to individuals or particular roles, settings or worksite cannot be identified from this present research and therefore warrants further investigation through future studies.

Both variable and case-based results have informed this finding in a *deductive* manner through confirming the assumption made by this research regarding safety climate exhibiting complexity. However, these same results have informed theory development through the identification of *equifinality* through the presence of multiple configurations of conditions for the different outcomes.

Each approach to analysis therefore informed the third research sub-question: *what is the relationship between workplace safety climate amongst nurses in rural clinical settings and their views of reporting/disclosure of a hypothetical medication error?* In order to improve rates of reporting and disclosure of error the elements that support this need to be identified. Teamwork and safety climate may be a means to achieve this. Through showing it is possible through a case-based approach to identify cases that may improve the capacity to do this, this research has the potential to inform further research regarding the relationship between safety climate and views of reporting and disclosing error.

Accepting health care as a complex system (Martin & Félix-Bortolotti, 2010) and use of a method acknowledging that complexity has contributed to the development of a new framework for understanding medication management. . This will now be discussed in more detail prior to the presentation of a proposed framework for medication management.

6.3.4 Evidence and sense-making through CCM

The concept of health care as a complex system was introduced in Chapter 3. Also introduced was the contrast between EBM (Evidence-Based Medicine Working Group, 1992) and complexity science (Lewin, 1999). Research was described as focused upon *evidence* or *sense-making* as means of knowledge generation (Martin & Félix-Bortolotti, 2010). The former tends to pursue knowledge as *truth* whereas the latter regards knowledge as developing *understanding* (Bennett et al., 2005).

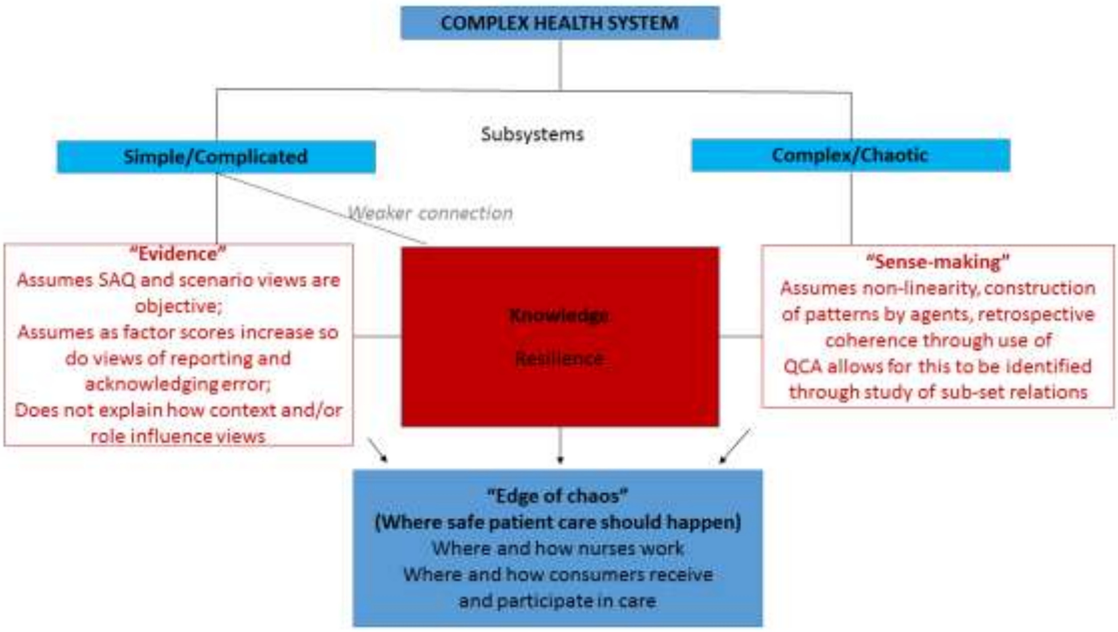

Figure 6-1: Approaches to knowledge generation from this research (based on Martin & Félix-Bortolotti, 2010, p. 418)

The use of CCM within a framework of knowledge generation within a complex health care system has added to understanding of the relationship between safety climate and views of reporting and disclosure of error. This has occurred through making reference to a *Safety II* approach for safe patient care. How this research has applied this framework is outlined in Figure 6-1.

Case-based results obtained for this research have therefore provided a capacity for describing the safety climate in rural clinical settings. The relationship between safety climate and views of reporting and disclosure has been explored and the aim of this research to *describe the complexity of safety climate of nurses working in rural clinical settings* has been achieved.

There are two ways that use of CCM within a framework of knowledge generation within the complex health care system has assisted the understanding of complexity through research. These are, the use of both *evidence* and *sense-making* (Martin & Félix-Bortolotti, 2010) to inform knowledge of resilience and the use of a transparent approach to compare configurations present for all outcome analysed (multiple outcomes analysis). This finding informs the fourth research sub-question of: *how is the understanding of the relationship between workplace safety climate and views of reporting medication error changed through the use of a configurational comparative method*?

The *simple/complicated* approach to research through pursuit of *evidence* used a questionnaire to identify difference. However, as noted earlier, this approach also allowed for the identification of teamwork and safety climate factors that were the conditions for the *fsQCA* and the areas where a *positive deviance* may exist with regards to views of reporting.

This reflects other research on safety climate and error which has primarily focused upon measurement of safety climate and views or actual reporting and disclosure (Etchegaray et al., 2011; Groves, 2014). Qualitative studies have also been undertaken in this area (Sheu et al., 2009) although these studies focus on the identification of similarities. There is little explanation in either of these approaches as to how any relationship between factors of safety climate impacts upon the individual clinician.

Hence, knowledge of the impact factors of safety climate may have upon how nurses work and where and how consumers receive and participate in care is not well understood. That is, the understanding of the *edge of chaos* where medication management occurs is limited.

The *complex/chaotic* approach to knowledge generation (Martin & Félix-Bortolotti, 2010) was possible using *fsQCA* through transparently comparing the configurations found for reporting and disclosure of different levels of harm. Patterns emerging from this comparison have informed knowledge of *resilience* through retrospective coherence (Martin & Félix-Bortolotti, 2010) of the configurational rows in the solution paths. .

A consistent approach to analysis assisted in this process. This was achieved through the capacity to compare cases and configurational rows fully consistent with each of the respective outcomes. .

As indicated in Chapter 3, complexity science does not dismiss the notion of *evidence* or cause-and-effect approaches to research (De Simone, 2006). It merely suggests that such approaches are not the only means of achieving knowledge. There is room for both within the framework presented in Figure 6-1.

This research has therefore used *sense-making* to assist understanding how safe medication management can occur through demonstrating the complexity in the relationship between safety climate and reporting and disclosure of error. This includes the potential of conjectural causality and equifinality amongst the solution terms obtained through fsQCA. In addition, the observation of some configurational roles consistent for an outcome and non-outcome in different settings and roles further supports that this relationship is asymmetrical and complex.

However, the discussion undertaken in Section 6.2.1 should also be recalled here noting that the results of this research relate to safety climate, and do not necessarily reflect *culture.* In addition, the configurational rows presented in the matrix tables, along with the solution terms resulting from the analysis with *fsQCA* that included worksite and workplace role, only relate to those with full consistency of the cases (Section 5.15).

There are therefore numerous examples of the outcome that are not explained by these fully consistent configurational rows.

Hence, what has occurred in this research is the identification of unusual cases (those fully consistent with the outcome) that could lead to improved understanding (through *sense making*) rather than the identification of causal elements of safety climate or culture. The use of CCM has provided the means of achieving this. Through future research current understanding of safety climate and views of reporting may be improved. This is discussed in more detail in Section 6.6.

Through the use of both the variable and case-based results, a framework is proposed that aims to enhance the understanding of the relationship between safety climate and views of reporting and disclosure of error.. This is discussed further in the following section.

6.4 Reframing error management understanding of complexity

Through applying a configurational comparative method that acknowledges complexity, this research has identified that *resilience* to safety climate may assist in the delivery of safe patient care. Both case and variable results allowed for understanding how factors of safety climate may influence nurses' views of reporting and disclosure. However, there are other issues that are raised by this research.

These relates not only to how nurses view error reporting and disclosure and the subsequent issues relating to error management but also to the delivery of safe patient care with respect to the management of medication management. That is, there is a *sense- making* of the *edge of chaos* where medication management occurs that has been achieved.

The previous section identified the need to focus more on *Safety II* approaches and suggested that safety climate and error management are both part of the delivery of safe patient care as an outcome, rather than focusing on safety climate as a means of intervention for error reporting and disclosure. This reframed focus is outlined in Figure

6-2. This appropriate management includes greater likelihood that any error would be disclosed and the acknowledgment of the near miss error to the patient suggests consumer involvement is more likely.

With such an approach, nurses are using error reporting and disclosure to ensure patient safety as an outcome, regardless of the safety climate they perceive. Because their approach is consistent despite the safety climate present the emergence of configurations for the outcome occurs (Dekker, 2011). Therefore, rather than needing positive safety climate factors for improved patient care a greater focus on safe patient care as an outcome may lead to the development of *resilience.*

This is not to suggest that efforts to improve either safety climate or error reporting should be discontinued. The purpose of this argument is to suggest there are other ways in which safe patient care may be achieved.

Langton's theory of how emergence affects local activity is relevant to this argument (Lewin, 1999). He postulated that the emergent elements influence the local activity which then feeds back to create further emergence.

Figure 6-2: Medication management at the *edge of chaos*

(Based on Langton's view of emergence in Lewin, 1999, p. 13)

The framework proposed here (*Figure 6-2*) implies that both *Safety I* and *Safety II* (Hollnagel, 2014) approaches may influence safe patient care. That is, the reporting and disclosure of error leads to improved understanding of error prevention that then feeds back to develop further emergence, in this case the emergence of *resilience*. Likewise, a focus on safe patient care as an outcome ensures the patient is involved in medication management and this feeds back to create more emergence of *resilience.*

The concept of *Safety I* focusing on measuring the absence of safety rather than its presence has already been identified (Hollnagel, 2014). So too was the importance of dealing with error appropriately, as there may be a valid understanding gained through examination of what may have caused the error to occur or in the event of a near miss what may have prevented harm (Bayazidi et al., 2012; Westbrook et al., 2015). In particular the consumer or patient should be informed through the process of open disclosure (Australian Commission for Safety and Quality in Health Care, 2013a).

Consumers should also be involved in the management of their medications. Improved involvement of consumers is regarded as a means for ensuring safe medication management (Australian Commission for Safety and Quality in Health Care, 2013b). If consumers are involved properly in health care it is possible for patient care to be an outcome within the health care system, rather than an intervention (Sturmberg, O'Halloran, & Martin, 2012). That is, safe patient care may be achieved.

The literature review outlines many of the developments undertaken by the ACSQHC regarding medication management. The guidelines relating specifically to management of allergies indicate that allergies should be documented as part of an appropriate assessment (Australian Commission for Safety and Quality in Health Care, 2013a). These areas need to be implemented for a *Safety II* approach.

Findings from public enquiries add further support to this argument. It was noted in the literature review that such enquires generally found one of two circumstances relating to how error was dealt with. Either clinicians had reported error(s) and these had not been investigated or dealt with by the establishment concerned (Queensland Health, 2005; Walshe & Offen, 2001), or clinicians failed to identify poor practice (Francis, 2013; Skinner et al., 2009). In each circumstance neither of the *Safety I* or *Safety II* approaches is evident.

In the case of failure to recognise poor practice it would not be possible to know *what should happen (Safety II),* nor would any poor practice or outcome be reported or disclosed. Failure to investigate errors that have been reported is also an example of how a *Safety II* approach was not present. As a result the organisations and health systems that were the subject of these enquiries were clearly not *resilient*.

Unfortunately, public enquiries tend to focus on what has caused severe error or why reporting of such error does not occur. In addition, research tends to focus on the same area. Therefore, it is possible we know more the elements of teamwork and safety climate that impact upon these areas. The *Safety II* approach may arguably alter this.

This area informs the main research question of this research which is: *how is safety climate related to views of reporting and disclosure of medication error amongst nurses working in rural clinical settings?* This research has shown the relationship to be complex and more than a simple *cause-and-effect* relationship that goes beyond the capabilities of Newtonian science. It also suggests that a different focus may further improve understanding in this area.

Determining the rationale for the differences found in this research is another area of future research that will be discussed later in this chapter. First, the limitations of the research need to be outlined.

6.5 Limitations of this research

There are several limitations to this research. Some of these have already been referred to in previous chapters with limitations relating to the method noted in Chapter 4 and some relating to the sample representativeness mentioned in Chapter 5.

This study also considered nurses' views of reporting and used a hypothetical medication error. In addition, studies observing clinicians suggest that actual reporting rates are lower than what nurses and other health professionals state they would report (Bayazidi et al., 2012; Westbrook et al., 2015). If what nurses in this present study think is happening, particularly if their views that the likelihood of near miss error being reported or disclosed is lower in reality (Section 5.7) then this is an obvious area of concern.

Social acceptability has been noted as a limitation in previous studies using questionnaires to assess safety climate (Etchegara et al., 2011; Halligan & Zecevic, 2011; Freeth et al., 2012). This must therefore be acknowledged as a possible limitation of this research. Social acceptability may be different in different settings and roles which may be an alternative explanation for the differences found in this present study. It is therefore a matter that is should be kept in mind when considering the results of this and other research.

The nature of the research design restricted the *fsQCA* analysis to the data obtained from the questionnaire. This meant the capacity to revisit cases was limited and so not all contradictory cases could be resolved. However, these cases were identified and the possibility of other areas influencing the outcomes of interest is an area for further research. This research also only considered a sufficiency cut-off of 1.0 and a lower threshold may provide different results. This has been highlighted in Section 5.15 and earlier in this chapter in Section 6.3.4.

Although the sample obtained represented approximately 6.7% of nurses working in the ASGC-RA 3—5 locations, the response to the survey was low (Section 5.3). As a result some the data were not sufficient to perform some analyses (such as experience in nursing and experience in current role). The PCA was also affected in that a confirmatory analysis of the data obtained for this research could not be undertaken (Section 5.6). These are limitations that may therefore have impacted the results.

In addition, the recruitment of participants was difficult. The student researcher's prior employment may have impacted responses. Post-code data were missing from some questionnaires and the inclusion of these responses, while transparent, may have affected the results. In addition, the timing of the research coincided with state government budget cuts which may have also had an impact upon results.

Issues in relation to representativeness of the sample have also been noted. There was a larger response from nurses in management roles from aged care settings and it is possible that enrolled nurses are under-represented. In some areas such as facility size and region it was not possible to determine the representativeness of the responses. Self-selection of participants is also an element that along with under-representative may also have been affected the results.

Sample size was not problematic for the analysis with *fsQCA*. However, there was a variety in the number of cases in different configurational rows and this may have skewed set membership results. However, there were also instances of single cases and it is not possible to infer from this study that these configurational rows would always result in the same outcome. Hence it should be re-emphasised that the use of fsQCA here has been to describe the data.

Two points may be made with respect to this. Firstly, this forms part of the description of the data, therefore assisting in meeting the aim of this research which is to *describe the complexity of safety climate of nurses working in rural clinical settings.* Secondly, this may indeed reflect the current status of safety climate and views of reporting and disclosure. If the goal is to improve each of these elements then over time it is possible this type of results will become more skewed.

Concerns regarding the accuracy of responses were also noted (Section 5.5). In particular, *Item 7* may not have been read correctly and it is therefore possible that other items may not be accurate as well. This has implications for the overall reliability of the data collection tool which may have influenced results in relation to teamwork and safety climate.

The limitations noted here also impact upon the generalisability of the results. The study was conducted amongst nurses in rural clinical settings in Tasmania. Although the findings reflect similar results from other studies any comparison made must be done with the limitations noted above kept in mind.

These limitations also reflect the contrasts in this research. The difficulty in obtaining a representative sample, along with the varying number of cases and the contradictions in the case-based results, reflects the noisiness of social science data (Schneider & Wagemann, 2012).

It may well be argued that if the health care system is truly complex and constantly changing, generalisability of the results of any study is not possible as over time due to this constant change. If this same research were to be repeated, the system would be different as would the people working within it. After all, people change jobs and even if they remain with a single employer, they may change roles.

Therefore, in order to determine if the findings of this research are generalizable, further research is required. This will now be considered further.

6.6 Future directions for research

Numerous options for future research are possible from the findings of this research. This includes further investigation of the complexity of safety climate in rural clinical settings, the use of CCM for further research as well as research relating to the reframing of error to enable safe practice to be achieved.

The finding of complex safety climate amongst nurses in rural clinical settings is an important one and the importance of the context of this research was identified earlier in this chapter (Section 6.1.1). Further research is required in relation to workplace setting, including the non-hospital sector. In addition, a focus on aged care settings to investigate the possible *positive deviance* of views of reporting and disclosure and how nurses working in these settings have become *resilient* is required.

Facility size and geography are also areas warranting further investigation. This study had limited responses from those working in remote/very remote settings (ASGC-RA 4—5) and there may be differences across these different areas of rurality.

Other areas worthy of further research are the roles of education and experience, both in terms of work experience and prior exposure to error and disclosure. Although not an element of this research, it has been highlighted by others as an important issue, particularly in relation to error disclosure (Harrison et al., 2014; Iedema et al., 2008). Consideration of research regarding the impact of education to improve the focus upon safe patient outcomes should be a priority.

Approaches to how research is undertaken also need to be addressed. Further research of health care as a complex system, particularly the use of *evidence* and *sense-making* for knowledge generation is required. The complexity of the practice arena should be matched with appropriate frameworks and methods.

The use of CCM in a more *deductive* research design to test the findings of this research is also a possibility. The use of CCM for hypothesis testing is an area that is recognised as being underutilised (Rihoux et al., 2009). It has been noted that larger-N studies with CCM tend to be more deductive (Greckhamer et al., 2013) therefore this method combined with a larger study to test the factor structure identified from PCA, is worth considering.

A further use of CCM is through the identification of cases that are unusual. Cases that are contradictory also offer an additional opportunity for research. The single case which viewed all error scenarios would be reported and disclosed is an example. Likewise, the cases where all factor scores were positive but were contradictory to the outcome of interest offer an opportunity to explore why they were not *resilient.* Although this was not possible to revisit cases in this research due to the anonymous nature of the design research design, future research could easily be designed to achieve this.

The overall focus of any research needs to be that of improving understanding of how safe patient care may be achieved. Both *Safety I* and *Safety II* approaches to error should involve the patient/consumer and both are necessary elements of safe practice. However, a greater focus upon *Safety II* is required if safe patient care is to be achieved. Along with this is an equally important need to focus on research that contributes to an understanding of the complexity of the health care system, in particular the edge of chaos where safe care is expected.

Although this research, and therefore the findings, is limited to nurses in rural clinical settings, other areas of health care should be considered for future research. In addition, the findings of this research may also have relevance to the management of error and other safety issues in the health care sector or even other industries.

6.7 Summary of this research

This research has applied a CCM research design within a framework of knowledge generation within a complex health system. This design also used the *funnel of complexity* (Rihoux & Lobe, 2009) to ensure the research aim was achieved.

The first phase, *before the analytical moment* was applied through consideration of the context and the literature as outlined in Chapter 2 and Chapter 3. That is, the context and theoretical knowledge was outlined to develop the research aim, question and sub-questions of this research. Included in this was a discussion of how knowledge is generated in a complex health care system (Martin & Félix-Bortolotti, 2010). This same phase identified the conditions and outcomes for analysis using a configurational comparative method, namely qualitative comparative analysis (QCA).

For this research, *fsQCA* was used primarily with crisp set (*csQCA)* calibration applied to demographic data. The detail of the method was provided in Chapter 4. This analysis was undertaken in the second *during the analytical moment* phase of the *funnel of complexity*.

Details of the results were provided in Chapter 5. Variable results identified differences, particularly in relation to workplace setting and work role. These results also suggested a relationship between some positive factor scores and views of reporting and disclosure. Case-based results identified numerous configurations were present for each of the outcomes of interest. The use of both variable and case-based results informed the findings of this research. Findings were also informed through the framework of knowledge generation within a complex health system.

Three key findings were obtained from this research. Firstly, the relationship between safety climate and views of reporting and disclosure of error amongst nurses in rural clinical settings is complex. Although variable-based results were able to identify this complexity, it was the case-based results that allowed for it to be described further. In addition, the subsequent analysis provided an interpretation that made theoretical sense.

This first finding provided a new understanding of the complexity of safety climate amongst nurses in rural clinical settings. It informed the aim of this research which was to *describe the complexity of safety climate of nurses working in rural clinical settings.* The research question determined to inform this aim was *how is safety climate related to views of reporting and disclosure of medication error amongst nurses working in rural clinical settings?* The nature of this relationship was identified to be complex.

Secondly, adopting a framework of health care as a complex system allowed for both *evidence* and *sense-making* to support the finding of complexity. This suggests the need for a paradigm shift for research within health care away from the dominance of evidence-based medicine. This does not mean that the *evidenced-based* approach is irrelevant and therefore should be abandoned but that research methods must be 'fit for purpose' and knowledge sourced from many areas. Through adopting new paradigms with new methods then complex issues such as that considered in this research may be better understood.

This finding also informed the aim and main research question. Complexity science offers an alternative paradigm to the linear thinking of evidence-based medicine and Newtonian science. However, it does not dismiss such a world view. In fact, the adaptation of Martin's framework (*Figure 6-1*) discussed in this chapter allows for a combination of both evidence and sense-making in order to inform knowledge (Martin & Félix-Bortolotti, 2010). That is, linear thinking alongside complexity has a role in assisting the understanding of *how safety climate is related to views of reporting and disclosure of medication error amongst nurses working in rural clinical settings*.

Finally, it is necessary to rethink error management. Although there may be a complex relationship between safety climate and views of error reporting and disclosure, it is safe practice as an outcome that needs to be the focus.

Traditional approaches have focused on what has gone wrong (*Safety I*) and through reconsidering the thesis results in relation to what has gone right or what should happen (*Safety II*) the outcome of interest becomes safe practice. Within a new view of error management safety climate, teamwork and other areas of influence form a complex web surrounding the two different approaches. When things go right we need to understand them. When things go wrong we also need to develop understanding. Central to this is the consumer who ideally should be involved in medication management at all times. In doing so, error reporting and disclosure move from outcomes of error management to becoming encompassed within the delivery of safe care.

However, if we are to address the problems of the complex health care system there is a risk that "*quality will wither (and costs blow out) if our paradigm of knowledge generation does not reflect reality*" (Martin & Félix-Bortolotti, 2010, p. 419). Complexity science reflects the reality of the complex world at the *edge of chaos* where nurses work and in which patients receive care.

Fuzzy set QCA, a configurational comparative method that is designed to research complex causality, allows for *sense-making* of the *edge of chaos* where nurses in rural clinical settings work. This *sense-making* has potential to not only assist the understanding of the influence of safety climate upon nurses views of medication error reporting and disclosure but to also inform knowledge in relation to safe practice in medication management.

As Battles argues (2006, p. i3) "*rather than continually measuring the width and depth of the quality chasm, we need to design and build the bridge to span it*". To achieve this we must *"design in quality and design out identifiable risks and hazards"* (Battles, 2006, p. i3).

In other words, instead of constantly measuring culture and/or error (the absence of safety) we need to adopt new ways of thinking and new ways of researching in order to understand what is required for implementation of safe practice. We not only need to understand how and why error occurs but how and why safe practice occurs.

Complexity science allows us to begin to understand the chasm of safety culture and safety climate and how it relates to nurses' views of reporting and disclosure of medication error. Although this research has not spanned the chasm, it has achieved the aim of describing the complexity of safety climate amongst nurses in rural clinical settings. In doing so, it has contributed a solid footing upon which further research and an understanding of safe patient care may be built.

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7 Appendices

Appendix 1 Ethics approval

Office of Research Services
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Private Bag 1
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Facsimile + 61 3 6226 7148
Email Human.Ethics@utas.edu.au
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HUMAN RESEARCH ETHICS COMMITTEE (TASMANIA) NETWORK

UTAS

11 May 2011

Assoc.Prof Erica Bell
Deputy Director
Department of Rural Health
University of Tasmania
Private Bag 103
Hobart TAS 7001

Dear Associate Professor Bell,

REF NO: H11688
TITLE: Getting the Truth: A Case-Based Qualitative Comparative Analysis of Nurses' Attitude to safety Climate and Their Views of reporting a Hypothetical Medication Error

- *Application Form, Low Risk*
- *Consent Form (online)*
- *Information Sheet (online)*
- *Attachment C- Survey dated 16 Feb 2011*
- *Attachment D- Invitation*
- *Attachment E- reminder letter*
- *Attachment F- Email to HACSU nurse members*
- *Response to ethics dated 29 April 2011*
- *Email correspondence dated 2 May 2011 from Deb Carnes to Katherine Shaw*

The Tasmania Health and Medical Human Research Ethics Committee considered and approved the above documentation on **5 May 2011.**

All committees operating under the Human Research Ethics Committee (Tasmania) Network are registered and required to comply with the *National Statement on the Ethical Conduct Human Research* (NHMRC 2007).

Therefore, the Chief Investigator's responsibility is to ensure that:

(1) The individual researcher's protocol complies with the HREC approved protocol.

(2) Modifications to the protocol do not proceed until **approval** is obtained in writing from the HREC.

(3) Section 5.5.3 of the National Statement states:

Researchers have a significant responsibility in monitoring approved research as they are in the best position to observe any adverse events or unexpected outcomes. They should report such events or outcomes promptly to the relevant institution/s and ethical review body/ies and take prompt steps to deal with any unexpected risks.

Tasmania
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The appropriate forms for reporting such events in relation to clinical and non-clinical trials and innovations can be located at the website below. All adverse events must be reported regardless of whether or not the event, in your opinion, is a direct effect of the therapeutic goods being tested. http://www.research.utas.edu.au/human_ethics/medical_forms.htm

(4)All research participants must be provided with the current Patient Information Sheet and Consent Form, unless otherwise approved by the Committee.

(5) The Committee is notified if any investigators are added to, or cease involvement with, the project.

(6) This study has approval for 4 years contingent upon annual review. A *Progress Report* is to be provided on the anniversary date of your approval. Your first report is due **5 May 2012.** You will be sent a courtesy reminder closer to this due date.

(7) A *Final Report* and a copy of the published material, either in full or abstract, must be provided at the end of the project.

Should you have any queries please do not hesitate to contact me on (03) 6226 1956.

Yours sincerely

Adele Kay
Health and Medical HREC Ethics Officer
On behalf of the Executive Officer
HREC (Tas) Network

Tasmania
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Appendix 2 Letter of invitation

Locked Bag 1372 Launceston
Crn Howick & Mulgrave Streets Launceston
Tasmania Australia 7250
Telephone (03) 6324 4000
Facsimile (03) 6324 4040
Email rural.health@utas.edu.au

UTAS

UNIVERSITY DEPARTMENT OF RURAL HEALTH

UNIVERSITY OF TASMANIA

Dear Rural Nurse

You are invited to participate in an online survey in the PhD research project:

Safety Climate and Reporting Medication Error – What Do Rural Nurses Think?

Nurses from a selection of rural worksites in Tasmania are invited to participate in this research study which is being conducted as part of my PhD.

You have received this information because you are a nurse and work in one of the rural worksites in Tasmania identified for the study. If you no longer work in a rural worksite then please disregard this information.

This information has been distributed to worksites through publicly available information obtained from websites such as DHHS, Aged Care Accreditation Standards Agency and TAS eHealth and at no stage have any members of this research study had access to your name or contact details.

To participate in the online survey please go to the following survey website link:

https://www.surveymonkey.com/s/rural_nurses_reporting_error

It will take about 10 – 15 minutes to complete the survey which will close on:

FRIDAY 30TH MARCH 2012 (5pm)

More detailed information regarding the study is available from the survey website link listed above.

To enhance the accuracy of data obtained in the study it is important that you complete the survey **once only.**

Thank you for taking your time to consider this study.

Sincerely

Debra Carnes
RN, BN, MNurs, MRCNA
PhD student

Appendix 3 Reminder letter

Locked Bag 1372 Launceston
Crn Howick & Mulgrave Streets Launceston
Tasmania Australia 7250
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UNIVERSITY DEPARTMENT OF RURAL HEALTH

UTAS

UNIVERSITY OF TASMANIA

Dear Rural Nurse

This is a reminder about an online survey in the PhD research project:

Safety Climate and Reporting Medication Error – What Do Rural Nurses Think?

Nurses working in a selection of rural worksites in Tasmania have been invited to participate in this research which is being conducted as part of my PhD.

Information was sent to you recently. However, you may have forgotten to complete the survey, or mislaid the information.

If you have already completed the survey then thank you for your time. To enhance the accuracy of data obtained in the study it is important that you complete the survey ***once only.***

To participate in the online survey please go to the following survey website link:

https://www.surveymonkey.com/s/rural_nurses_reporting_error

The survey will close on:

MON 30TH APRIL 2012 (5PM)

(NOTE: closing date extended from original closing date as advised to worksites by mail)

More detailed information regarding the study is available from the survey website link listed above.

Thank you for taking the time to read this information and remember, the survey will close on:

MON 30TH APRIL 2012 (5pm)

Sincerely

Debra Carnes
RN, BN, MNurs, MRCNA
PhD student

Appendix 4 Questionnaire

Safety Climate and Reporting Error - What Do Rural Nurses Think?

SAFETY CLIMATE AND REPORTING MEDICATION ERROR –
WHAT DO RURAL NURSES THINK?

INFORMATION SHEET

Invitation:

You are invited to participate in a research study into the relationship between error severity, safety climate and views of error reporting by nurses in rural worksites.

The study is being conducted by:
Student Investigator:
Debra Carnes
UDRH

Chief Investigator:
Assoc Prof Erica Bell
Deputy Director
UDRH

Other Investigator:
Prof Sue Kilpatrick
Pro-Vice Chancellor (Rural and Regional)
Deakin University

Whilst the student researcher is an employee of DHHS the following should be noted:
• The employment status of the student researcher is casual only
• The nature of the student researcher's employment with DHHS is unrelated to the study
• The location of the student researcher's employment is Royal Hobart Hospital (RHH) which is not one of the study worksites

1. What is the purpose of this study?
To obtain information for PhD research study at University Department of Rural Health (UDRH), University of Tasmania about error severity, safety climate and views of reporting/disclosure by nurses in rural worksites

2. Why have I been invited to participate in this study?
You are eligible to participate in this study because you are employed as a nurse in one of the rural worksites identified for this study. Nurses employed in these sites has been invited to participate and receive this information which has been distributed through publicly available information or you may have received it if you are a member of union and/or professional body. The researchers involved in the project have not had access to your contact or workplace details.

4. What does this study involve?
The study involves completion of an online survey. It will take about 10 – 15 minutes to complete the survey which is available on the link:
(insert link – surveymonkey.com.au/survey name)

You don't have to identify yourself in the survey. Minimal demographic data is being collected so that no-one can be identified from their anonymous response. Individual worksites will not be identified in any publications.

Involvement is this study is voluntary. While we would be pleased to have you participate, we respect your right to decline. There will be no consequences to you if you decide not to participate, and this will not affect your employment or membership of the organisation through which you received this information. As your response is anonymous then it will not be possible to withdraw your survey once it has been completed.

All information will be treated in a confidential manner, and your name will not be used in any publication arising out of the research. All of the research will be kept electronically on secure servers or in a locked cabinet in the office of the UDRH. The data will be kept for no longer than five years and will be destroyed when it is no longer required.

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5. Are there any possible benefits from participation in this study?
It is anticipated that the results from this study will assist in understanding the relationship between organisational safety climate, error severity and error reporting amongst nurses and may assist in improving the understanding and management of medication error in small clinical settings.

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6. Are there any possible risks from participation in this study?
There are no specific risks anticipated with participation in this study beyond discomfort

The survey contains an error scenario and it is possible that if you have experienced a similar situation in your workplace then you may be sensitive to its contents

In the event that you need to talk to someone about this then you may find the following information useful:

a. Seek help from a health professionals such as your General Practitioner
b. Beyond Blue (Ph: 1300 22 4636, Email: infoline@beyondblue.org.au, Website: beyondblue.org.au)
c. Lifeline (Ph: 13 11 14)
d. Your workplace may offer an Employee Assistance Programme (EAP) - information should be available in your workplace

7. What if I have questions about this research?
If you require further information this can be obtained from the Student Researcher Deb Carnes (dmcarnes@postoffice.utas.edu.au) or Chief Investigator Assoc Prof Erica Bell (Erica.Bell@utas.edu.au) on Ph: 03 6324 4000

In addition to forming the basis of a PhD thesis (a copy of which will be provided to the University of Tasmania and may be accessible through the University Library) it is possible that the results of this study may be published at conferences and/or in peer-reviewed journals.

This study has been approved by the Tasmanian Human Research Ethics Committee Network. If you have concerns or complaints about the conduct of this study you should contact the Executive Officer of the HREC (Tasmania) Network on (03) 6226 7479 or email human.ethics@utas.edu.au. The Executive Officer is the person nominated to receive complaints from research participants. You will need to quote [HREC project number].

THANK YOU FOR TAKING THE TIME TO CONSIDER THIS STUDY

TO PRINT THE ABOVE INFORMATION PLEASE CHOOSE 'FILE' THEN 'PRINT' TO PRINT THIS PAGE

SAFETY CLIMATE AND REPORTING MEDICATION ERROR –
WHAT DO RURAL NURSES THINK?

CONSENT INFORMATION

1. I acknowledge I have read and understood the information on the previous pages related to this study.
2. The nature and possible effects of the study have been explained to me.
3. I understand that the study involves completion of an anonymous online survey
4. I understand that participation involves low risk that is no greater than discomfort
5. I understand that all research data will be securely stored on secure servers or at the University of Tasmania premises for at least five years and will be destroyed when no longer required.
6. Any questions that I have asked have been answered to my satisfaction.
7. I agree that research data gathered from me for the study may be published provided that I cannot be identified as a participant.
8. I understand that my response is anonymous and any information I supply to the researchers will be used only for the purposes of the research.
9. I agree to participate in this investigation and understand that as my response is anonymous it will not be possible to withdraw my survey once it is submitted.

Safety Climate and Reporting Error - What Do Rural Nurses Think?

Do you agree with the above statements and therefore consent to participate in this study?

○ Yes

○ No

Thank you for your interest in this research.

If you wish to participate you need to indicate that you have read and understood the information in relation to the study.

If you have answered "NO" because you do not wish to participate in the survey then please use the "EXIT THIS SURVEY" link in the top right of your screen

If you have indicated "NO" but do wish to participate then please use the "PREV" button below to return to the previous page

Please answer the following items with respect to your current workplace

Please read each question carefully and indicate one response to each using the following scale:

1 = disagree strongly
2 = disagree slightly
3 = neutral
4 = agree slightly
5 = agree strongly
X = not applicable

This section has been based on:

Hutchinson, A., Cooper, K. L., Dean, J. E., McIntosh, A., Patterson, M., Stride, C. B., Laurence, B. E., & Smith, C. M. (2006). Use of a safety climate questionnaire in UK health care: factor structure, reliability and usability. Qual Saf Health Care, 15(5), 347-353.

Sexton, J. B., Helmreich, R. L., Neilands, T. B., Rowan, K., Vella, K., Boyden, J., Roberts, P. R., & Thomas, E. J. (2006). The Safety Attitudes Questionnaire: psychometric properties, benchmarking data, and emerging research. BMC Health Serv Res, 6, 44.

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Safety Climate and Reporting Error - What Do Rural Nurses Think?

Please answer the following questions in relation to the teamwork climate of your current workplace.

	disagree strongly	disagree slightly	neutral	agree slightly	agree strongly	not applicable
1. Nurse input is well received where I work	○	○	○	○	○	○
2. Where I work it is difficult to speak up if I perceive a problem with patient care	○	○	○	○	○	○
3. Decision making where I work uses input from relevant staff	○	○	○	○	○	○
4. The doctors and nurses here work together as a well coordinated team	○	○	○	○	○	○
5. Disagreements where I work are resolved appropriately (ie not who is right but what is best for the patient)	○	○	○	○	○	○
6. I am frequently unable to express disagreement with the senior clinical staff here	○	○	○	○	○	○
7. It is easy for staff here to ask questions when there is something they do not understand	○	○	○	○	○	○
8. I have the support I need from other staff to care for patients	○	○	○	○	○	○
9. I know the first and last names of all the staff I worked with during my last shift	○	○	○	○	○	○
10. Important issues are well communicated at shift changes	○	○	○	○	○	○
11. Briefing staff on handovers between shifts/periods of work (ie to plan for possible contingencies) is important for patient safety	○	○	○	○	○	○
12. Briefings are common where I work	○	○	○	○	○	○
13. I am satisfied with the quality of collaboration that I experience with senior doctors where I work	○	○	○	○	○	○
14. I am satisfied with the quality of collaboration that I experience with nurses where I work	○	○	○	○	○	○

Safety Climate and Reporting Error - What Do Rural Nurses Think?

Please answer the following questions in relation to the safety climate of your current workplace

	disagree strongly	disagree slightly	neutral	agree slightly	agree strongly	not applicable
15. The levels of staffing where I work are sufficient to handle the number of patients	○	○	○	○	○	○
16. I would feel safe being treated as a patient in this service	○	○	○	○	○	○
17. I am encouraged by my colleagues to report any patient safety concerns I may have	○	○	○	○	○	○
18. Staff frequesntly disregard rules or guidelines (eg hand-washing, treatment protocols/clinical pathways etc) that are extablished for the area where I work	○	○	○	○	○	○
19. The culture where I work makes it easy to learn from the errors of others	○	○	○	○	○	○
20. I receive appropriate feedback about my performance	○	○	○	○	○	○
21. Medical errors are handled appropriately here	○	○	○	○	○	○
22. I know the proper channels to which I should direct questions regarding patient safety	○	○	○	○	○	○
23. Where I work it is difficult to discuss errors	○	○	○	○	○	○
24. Management does not knowingly compromise the safety of patients	○	○	○	○	○	○
25. This organisation is doing more for patient safety than it did one year ago	○	○	○	○	○	○
26. Leadership is driving us to be a safety centred organisation	○	○	○	○	○	○
27. My suggestions about safety would be acted upon if I expressed them to management	○	○	○	○	○	○

Please choose one response to each of the following questions

This section has been adapted from:

Weissman, J. S., Annas, C. L., Epstein, A. M., Schneider, E. C., Clarridge, B., Kirle, L., Gatsonis, C., Feibelmann, S., & Ridley, N. (2005). Error reporting and disclosure systems: views from hospital leaders. Jama, 293(11), 1359-1366.

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A client of your health care service is discovered to have a urinary tract infection. A doctor has ordered Trimethoprim to threat the infection, not realising that the patient has a previously documented severe allergy to this drug.

Suppose about an hour after taking the medication the client complains of difficutly breathing and soon after is unable to speak.

Ten minutes later, he becomes unresponsive .

Resuscitation is successful but the client remains in a coma for 5 days. When he regains consciousness, he is unable to communicate and this remains unchanged 1 year later.

	Always	Usually	Sometimes	Rarely	Never
28. In your current workplace how often would this kind of incident be formally reported?	○	○	○	○	○
29. How often would someone from your workplace acknowledge to patients/clients or their family members that an incident of this kind occurred?	○	○	○	○	○

Suppose the outcome were somewhat less severe.

Suppose an hour after receiving the medication the client complains of difficulty breathing and has an itchy rash. With treatment the symptoms resolve after 2 hours.

The client is monitored but has no further symptoms.

	Always	Usually	Sometimes	Rarely	Never
30. In your current workplace how often would this kind of incident be formally reported?	○	○	○	○	○
31. How often would someone from your workplace acknowledge to patients/clients or their family members that an incident of this kind occurred?	○	○	○	○	○

Now suppose the same situation occurred and the outcome is even less dramatic.

The day after the client is given the medication, the documented allergy is noted and the medication is ceased. The client has no allergy symptoms.

	Always	Usually	Sometimes	Rarely	Never
32. In your current workplace how often would this kind of incident be formally reported?	○	○	○	○	○
33. How often would someone from your workplace acknowledge to patients/clients or their family members that an incident of this kind occurred?	○	○	○	○	○

Please choose one response to each of the following questions

34. Please indicate your level of registration

- ○ Registered Nurse
- ○ Enrolled Nurse
- ○ Enrolled Nurse - Medication Endorsed

35. Please indicate the main location of your work

- Work in hospital/multi-purpose setting
- Work in community (including CAPS/EACH)
- Work in residential aged care setting
- Work in mental health setting
- Work in General Practice
- Work in disability services
- Other

36.How many beds does your hospital/workplace setting have?

- less than 50 beds
- 50 - 99 beds
- 100+ beds
- Unsure
- Other/not applicable

37. Please indicate the main type of work you do

- Clinical role
- Management role
- Other

38.Do you work for the Government (DHHS) or a private sector employer?

- Work for Government (DHHS)
- Work for Non-Government/private sector
- Unsure

39. Please indicate your experience in your current workplace

- Less than 6 months
- from 6 months to less than 1 year
- from 1 year to less than 3 years
- from 3 years to less than 8 years
- from 8 years to less than 13 years
- from 13 years to less than 21 years
- 21 years or more

40. Please indicate your experience in nursing

- Less than 6 months
- from 6 months to less than 1 year
- from 1 year to less than 3 years
- from 3 years to less than 8 years
- from 8 years to less than 13 years
- from 13 years to less than 21 years
- 21 years or more

41. Please indicate the postcode setting of your workplace

Note: This information will not be published. It will be used to analyse data in relation to regional (North, South, North-west) and other geographic location classifications (eg ARIA, AGSC-RA)

POST CODE

THANK YOU FOR YOUR TIME

Appendix 5 Additional tables (Chapter 4)

Table 7-1 *ASGC-RA and Region Locations by Post-code*

SOUTH			NORTH			NW		
postcode	ASGC-RA		postcode	ASGC-RA		postcode	ASGC-RA	
7022	3		7209	3		7305	3	
7023	3		7210	3		7306	3	
7024	3		7211	3		7307	3	
7025	3		7212	3		7310	3	
7026	3		7213	3		7315	3	
7027	3		7214	3		7316	3	
7030	3		7215	3		7320	3	
7109	3		7216	3		7321	3	
7112	3		7252	3		7322	3	
7113	3		7253	3		7325	3	
7116	4		7254	3		7330	3	
7117	3		7255	5		7331	3	
7119	3		7256	5		7466	4	
7120	3		7257	5		7467	4	
7139	3		7259	3		7468	4	
7140	3		7260	3		7469	4	
7150	3		7261	3		7470	4	
7154	3		7262	3				
7155	3		7263	3				
7162	3		7264	4				
7163	3		7265	3				
7171	3		7267	3				
7172	3		7270	3				
7174	3		7275	3				
7175	3		7276	3				
7176	3		7300	3				
7177	3		7301	3				
7178	3		7302	3				
7179	3		7303	3				
7180	3		7304	3				
7182	3							
7183	3							
7184	3							
7185	3							
7186	3							
7187	3							
7190	3							

Table 7-2 *Rationale for demographic data collection*

Question	Answer options	Rationale
Please indicate your level of registration	RN, EN	RN and EN scope of practice is different including specifically in relation to administering medications It is worth assessing if this has an impact upon safety climate or views of reporting
Please indicate the main location of your work	Community, hospital/multipurpose service, residential aged care, mental health service, disability services, other	Previous study in NHS (Hutchinson et al., 2006) indicates a higher level of reliability in SAQ from hospital settings therefore collecting this data will allow for benchmarking
Please indicate the main type of work you do	Clinical, management other	Previous study in NHS indicates greater reliability in SAQ amongst 'clinicians' (Hutchinson et al., 2006). Study in USA regarding views of reporting and disclosure was only administered to senior management (Weissman et al., 2005) Collecting above data will allow for benchmarking each of these data sets
Please indicate your experience in your current workplace	As per SAQ	Previous study (De Wet, Johnson, Mash, McConnachie, & Bowie, 2010) has indicated that more experienced staff have a higher view of safety climate therefore by collecting this data benchmarking can be undertaken
Please indicate your experience in nursing	As per SAQ	As above.
Do you work for Government or private sector employer	Work for DHHS/Government, Work for non-government/private sector, Unsure	Will allow analysis of data based upon sector of employment

How many beds does your hospital/ workplace have?	<50, 50 – 99, 100+, unsure, other/Not applicable	Will allow analysis of data based upon hospital/facility size. Criteria applied here has been used previously in studies re safety in US rural hospitals (Loux, Payne, & Knott, 2005)
Please provide the postcode of your workplace	It is a requirement of the study that a worksite is located in AGSC-RA 3-5 location (by postcode). Collecting this data ensures the data being collected matches the inclusion criteria Postcode data will also allow worksites to be grouped into Regions (N, S, NW) and other geographical classification such as ARIA in order to conduct analysis. In some cases these classifications may be merged to ensure that worksites cannot be identified.	Data regarding error (including medication error) is not currently collected at a national level regarding 'rurality'. There are plans to undertake this level of analysis (Australian Institute of Health and Welfare, 2008) therefore it is prudent to consider this aspect. Worksite name, gender data and age data will not be collected. Due to the small numbers of nurses in worksites there is a potential risk of participants being identified from this type of data.

Table 7-3 *Consideration of heterogeneity and homogeneity*

INCLUDED TO IMPROVE HOMOGENEITY		***INCLUDED TO IMPROVE HETEROGENEITY***	
Rural Clinical settings	Rural clinical settings allows for one geographical area of nursing practice	**Variety of clinical settings**	Whilst rural specific workplaces have been chosen they cover a wide variety of clinical areas including hospital/community/mental health/residential aged care thus intending a broad heterogeneity of workplace culture and nursing practice
		"Rurality"	Workplaces will be grouped into groups indicating ASGC-RA (Australian Statistical Geographical Categories – Rural Area is a classification based upon 2006 Census data compiled by the Australian Bureau of Statistics
Nurses	One professional group. Nurses administer medication and are likely to be in a position to assess the occurrence of an error.	**Role of nurse**	Past administration of SAQ suggests a greater reliability when administered to clinicians therefore differentiating 'management' from 'clinical' roles is warranted.
Error scenario	One single scenario with three different outcomes. The aim is to minimise other factors such as cause of error having an impact upon reporting practices.	**Error outcome**	Three clearly different outcomes from a single hypothetical error.

Appendix 6 SPSS Outputs Normality of Data

Table 7-4 *Tests for Normality (SAQ items)*

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
1. Nurse input is well received where I work	.359	116	.000	.630	116	.000
2. Where I work it is difficult to speak up if I perceive a problem with patient care	.312	116	.000	.708	116	.000
3. Decision making where I work uses input from relevant staff	.344	112	.000	.672	112	.000
4. The doctors and nurses here work together as a well coordinated team	.247	115	.000	.831	115	.000
5. Disagreements where I work are resolved appropriately (ie not who is right but what is best for the patient)	.246	114	.000	.798	114	.000
6. I am frequently unable to express disagreement with the senior clinical staff here	.300	114	.000	.810	114	.000
7. It is easy for staff here to ask questions when there is something they do not understand	.300	114	.000	.810	114	.000
8. I have the support I need from other staff to care for patients	.395	116	.000	.646	116	.000
9. I know the first and last names of all the staff I worked with during my last shift	.485	116	.000	.411	116	.000
10. Important issues are well communicated at shift changes	.282	116	.000	.809	116	.000
11. Briefing staff on handovers between shifts/periods of work (ie to plan for possible contingencies) is important for patient safety	.485	116	.000	.393	116	.000
12. Briefings are common where I work	.257	116	.000	.813	116	.000
14. I am satisfied with the quality of collaboration that I experience with nurses where I work	.339	116	.000	.734	116	.000

15. The levels of staffing where I work are sufficient to handle the number of patients	.244	116	.000	.853	116	.000
16. I would feel safe being treated as a patient in this service	.320	116	.000	.736	116	.000
17. I am encouraged by my colleagues to report any patient safety concerns I may have	.388	115	.000	.608	115	.000
18. Staff frequently disregard rules or guidelines (eg hand-washing, treatment protocols/clinical pathways etc) that are established for the area where I work	.269	116	.000	.772	116	.000
19. The culture where I work makes it easy to learn from the errors of others	.258	116	.000	.850	116	.000
20. I receive appropriate feedback about my performance	.231	116	.000	.833	116	.000
21. Medical errors are handled appropriately here	.280	116	.000	.785	116	.000
22. I know the proper channels to which I should direct questions regarding patient safety	.478	116	.000	.431	116	.000
23. Where I work it is difficult to discuss errors	.264	116	.000	.783	116	.000
24. Management does not knowingly compromise the safety of patients	.379	115	.000	.677	115	.000
25. This organisation is doing more for patient safety than it did one year ago	.192	116	.000	.904	116	.000
26. Leadership is driving us to be a safety centred organisation	.257	116	.000	.821	116	.000
27. My suggestions about safety would be acted upon if I expressed them to management	.282	116	.000	.739	116	.000

a. Lilliefors Significance Correction

Table 7-5 *Tests for Normality (views of reporting and disclosure)*

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
28. In your current workplace how often would this kind of incident be formally reported?	.479	115	.000	.479	115	.000
Formally report severe error	.495	115	.000	.480	115	.000
29. How often would someone from your workplace acknowledge to patients/clients or their family members that an incident of this kind occurred?	.300	115	.000	.717	115	.000
Acknowledge severe error to patient/client or family	.360	115	.000	.634	115	.000
30. In your current workplace how often would this kind of incident be formally reported?	.382	114	.000	.641	114	.000
Formally report moderate error	.421	114	.000	.599	114	.000
31. How often would someone from your workplace acknowledge to patients/clients or their family members that an incident of this kind occurred?	.260	113	.000	.777	113	.000
Acknowledge moderate error to patient/client or family	.370	113	.000	.632	113	.000
32. In your current workplace how often would this kind of incident be formally reported?	.261	114	.000	.798	114	.000
Formally report near miss error	.363	114	.000	.634	114	.000
33. How often would someone from your workplace acknowledge to patients/clients or their family members that an incident of this kind occurred?	.241	115	.000	.875	115	.000
Acknowledge near miss error to patient/client or family	.462	115	.000	.547	115	.000

a. Lilliefors Significance Correction

Table 7-6 *Tests for Normality (Demographic Information)*

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
34. Please indicate your level of registration	.536	115	.000	.297	115	.000
Level of registration	.536	115	.000	.297	115	.000
35. Please indicate the main location of your work	.272	115	.000	.748	115	.000
Workplace setting	.303	115	.000	.784	115	.000
36. How many beds does your hospital/workplace setting have?	.251	114	.000	.774	114	.000
38. Do you work for the Government (DHHS) or a private sector employer?	.418	114	.000	.625	114	.000
Employment sector	.421	114	.000	.599	114	.000
Experience in current role	.197	115	.000	.924	115	.000
Experience in nursing	.329	115	.000	.721	115	.000
41. Post-code	.226	111	.000	.868	111	.000
41. ASGC-RA	.531	111	.000	.280	111	.000
41. ASGC-RA (remote/very remote combined)	.537	111	.000	.282	111	.000
41. Region	.342	111	.000	.729	111	.000

a. Lilliefors Significance Correction

Appendix 7 Chi-squared tables (sensitivity tests)

Table 7-7 *Chi-squared of workplace role and teamwork and patient safety at bedside (responses missing post-code data excluded)*

Teamwork and patient safety at bedside		Workplace role		Total
		Clinical role	**Management role**	
Positive	Count	50	18	68
	% within Workplace role	71.4%	94.7%	76.4%
	% of Total	56.2%	20.2%	76.4%
Not positive	Count	20	1	21
	% within Workplace role	28.6%	5.3%	23.6%
	% of Total	22.5%	1.1%	23.6%
Total	Count	70	19	89
	% within Workplace role	100.0%	100.0%	100.0%
	% of Total	78.7%	21.3%	100.0%

χ^2=3.303[b], df=1, N=99, p=0.069[b], Phi=-0.225, Fisher's Exact=0.036

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 4.48.

b. Computed only for a 2x2 table

Table 7-8 *Chi-squared for leadership and error management and acknowledgment of moderate error (responses missing post-code data excluded)*

Acknowledge moderate error to patient/client or family		Leadership and error management: positive	Leadership and error management: not positive	Total
Always	Count	36	5	41
	% within Leadership and error management	49.3%	20.0%	41.8%
	% of Total	36.7%	5.1%	41.8%
Not Always	Count	37	20	57
	% within Leadership and error management	50.7%	80.0%	58.2%
	% of Total	37.8%	20.4%	58.2%
Total	Count	73	25	98
	% within Leadership and error management	100.0%	100.0%	100.0%
	% of Total	74.5%	25.5%	100.0%

χ^2=5.427[b], df=1, N=98, p=0.020[b], Phi=-0.259, Fisher's Exact=0.011
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 10.46.
b. Computed only for a 2x2 table

Table 7-9 *Chi-squared for teamwork and patient safety at bedside and facility bed numbers (responses missing post-code data excluded)*

Teamwork and patient safety at bedside		Facility bed numbers: less than 50 beds	50 - 99 beds	100+ beds	Other/not applicable	Total
positive	Count	30	15	6	15	66
	% within facility bed numbers	78.9%	55.6%	46.2%	83.3%	68.8%
	% of Total	31.2%	15.6%	6.2%	15.6%	68.8%
not positive	Count	8	12	7	3	30
	% within facility bed numbers	21.1%	44.4%	53.8%	16.7%	31.2%
	% of Total	8.3%	12.5%	7.3%	3.1%	31.2%
Total	Count	38	27	13	18	96
	% within facility bed numbers	100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total	39.6%	28.1%	13.5%	18.8%	100.0%

χ^2=8.898[a], df=1, N=96, p=0.031, Fisher's Exact=0.034

a. 1 cells (12.5%) have expected count less than 5. The minimum expected count is 4.06

Table 7-10 *Chi-squared of view of reporting severe error and workplace setting (responses missing post-code data excluded)*

Formally report severe error		Workplace setting: Hospital/ Multi-purpose	Community	Residential aged care	Total
Always	Count	42	17	23	82
	% within Workplace setting	77.8%	70.8%	95.8%	80.4%
	% of Total	41.2%	16.7%	22.5%	80.4%
Not Always	Count	12	7	1	20
	% within Workplace setting	22.2%	29.2%	4.2%	19.6%
	% of Total	11.8%	6.9%	1.0%	19.6%
Total	Count	54	24	24	102
	% within Workplace setting	100.0%	100.0%	100.0%	100.0%
	% of Total	52.9%	23.5%	23.5%	100.0%

χ^2=5.255[a], *df=1, N=102, p=0.072, Fisher's Exact=0.066*

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 4.71.

Table 7-11 *Chi-squared acknowledgment of near miss error and workplace setting (responses missing post-code data excluded)*

Acknowledge near miss error to patient/client or family		Workplace setting: Hospital/ Multi-purpose	Community	Residential aged care	Total
Always	Count	8	3	16	27
	% within Workplace setting	14.8%	12.5%	66.7%	26.5%
	% of Total	7.8%	2.9%	15.7%	26.5%
Not Always	Count	46	21	8	75
	% within Workplace setting	85.2%	87.5%	33.3%	73.5%
	% of Total	45.1%	20.6%	7.8%	73.5%
Total	Count	54	24	24	102
	% within Workplace setting	100.0%	100.0%	100.0%	100.0%
	% of Total	52.9%	23.5%	23.5%	100.0%

χ^2=26.099, *df=1, N=102, p=0.000, Fisher's Exact=0.000*

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.35

Table 7-12 *Chi-squared acknowledgement of moderate error and workplace setting (responses missing postcode data excluded)*

Acknowledge moderate error to patient/client or family		Workplace setting: Hospital/ Multi-purpose	Community	Residential aged care	Total
Always	Count	21	5	20	46
	% within Workplace setting	39.6%	20.8%	83.3%	45.5%
	% of Total	20.8%	5.0%	19.8%	45.5%
Not Always	Count	32	19	4	55
	% within Workplace setting	60.4%	79.2%	16.7%	54.5%
	% of Total	31.7%	18.8%	4.0%	54.5%
Total	Count	53	24	24	101
	% within Workplace setting	100.0%	100.0%	100.0%	100.0%
	% of Total	52.5%	23.8%	23.8%	100.0%

χ^2=20.477, df=1, N=101, p=0.000, Fisher's Exact=0.000

a. 1 cells (12.5%) have expected count less than 5. The minimum expected count is 4.06

Appendix 8 Chi squared tables (Demographic)

Table 7-13 *Chi-squared test of workplace role and region*

Workplace role		Region			Total
		South	North	North west	
Clinical role	Count	17	22	49	88
	% within Region	81.0%	78.6%	80.3%	80.0%
	% of Total	15.5%	20.0%	44.5%	80.0%
Management role	Count	4	6	12	22
	% within Region	19.0%	21.4%	19.7%	20.0%
	% of Total	3.6%	5.5%	10.9%	20.0%
Total	Count	21	28	61	110
	% within Region	100.0%	100.0%	100.0%	100.0%
	% of Total	19.1%	25.5%	55.5%	100.0%

χ^2=0.052[a], df=2, N=110, p=1.000, Fisher's Exact Test p=1.000
a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 4.20.

Table 7-14 *Chi-squared test of region and facility bed numbers*

Region		Facility bed numbers: less than 50 beds	50 - 99 beds	100+ beds	Other/not applicable	Total
South	Count	5	7	0	9	21
	% within facility bed numbers	11.6%	25.0%	0.0%	39.1%	19.6%
	% of Total	4.7%	6.5%	0.0%	8.4%	19.6%
North	Count	22	2	2	3	29
	% within facility bed numbers	51.2%	7.1%	15.4%	13.0%	27.1%
	% of Total	20.6%	1.9%	1.9%	2.8%	27.1%
North west	Count	16	19	11	11	57
	% within facility bed numbers	37.2%	67.9%	84.6%	47.8%	53.3%
	% of Total	15.0%	17.8%	10.3%	10.3%	53.3%
Total	Count	43	28	13	23	107
	% within facility bed numbers	100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total	40.2%	26.2%	12.1%	21.5%	100.0%

χ^2=30.186[a], df=6, N=107, p=0.000, Fisher's Exact Test p=0.000
a. 3 cells (25.0%) have expected count less than 5. The minimum expected count is 2.55.

Table 7-15 *Chi-squared test of region and workplace setting*

Region		Workplace setting: Hospital/ Multi-purpose	Community	Residential aged care	Total
South	Count	4	6	7	17
	% within Workplace setting	7.4%	25.0%	29.2%	16.7%
	% of Total	3.9%	5.9%	6.9%	16.7%
North	Count	17	5	6	28
	% within Workplace setting	31.5%	20.8%	25.0%	27.5%
	% of Total	16.7%	4.9%	5.9%	27.5%
North west	Count	33	13	11	57
	% within Workplace setting	61.1%	54.2%	45.8%	55.9%
	% of Total	32.4%	12.7%	10.8%	55.9%
Total	Count	54	24	24	102
	% within Workplace setting	100.0%	100.0%	100.0%	100.0%
	% of Total	52.9%	23.5%	23.5%	100.0%

χ^2=7.493[a], df=4, N=102, p=0.113, Fisher's Exact Test p=0.101
a. 2 cells (22.2%) have expected count less than 5. The minimum expected count is 4.00.

Table 7-16 *Chi-squared test of workplace setting and workplace role*

Workplace setting		Workplace role: Clinical role	Management role	Total
Hospital/ Multi-purpose	Count	47	10	57
	% within Workplace role	56.0%	47.6%	54.3%
	% of Total	44.8%	9.5%	54.3%
Community	Count	23	1	24
	% within Workplace role	27.4%	4.8%	22.9%
	% of Total	21.9%	1.0%	22.9%
Residential aged care	Count	14	10	24
	% within Workplace role	16.7%	47.6%	22.9%
	% of Total	13.3%	9.5%	22.9%
Total	Count	84	21	105
	% within Workplace role	100.0%	100.0%	100.0%
	% of Total	80.0%	20.0%	100.0%

χ^2=11.017[a], *df=2, N=105, p=0.004, Fisher's Exact Test p=0.005*
a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 4.80.

Table 7-17 *Chi-squared test of workplace setting and facility bed numbers*

Workplace setting		Facility bed numbers: less than 50 beds	50 - 99 beds	100+ beds	Other/not applicable	Total
Hospital/ Multi-purpose	Count	35	10	9	1	55
	% within facility bed numbers	74.5%	38.5%	69.2%	6.2%	53.9%
	% of Total	34.3%	9.8%	8.8%	1.0%	53.9%
Community	Count	6	1	0	15	22
	% within facility bed numbers	12.8%	3.8%	0.0%	93.8%	21.6%
	% of Total	5.9%	1.0%	0.0%	14.7%	21.6%
Residential aged care	Count	6	15	4	0	25
	% within facility bed numbers	12.8%	57.7%	30.8%	0.0%	24.5%
	% of Total	5.9%	14.7%	3.9%	0.0%	24.5%
Total	Count	47	26	13	16	102
	% within facility bed numbers	100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total	46.1%	25.5%	12.7%	15.7%	100.0%

χ^2=77.523[a], df=6, N=102, p=1.000, Fisher's Exact Test p=1.000
a. 4 cells (33.3%) have expected count less than 5. The minimum expected count is 2.80.

Table 7-18 *Chi squared test of work role and facility bed numbers*

Workplace role		Facility bed numbers: less than 50 beds	50 - 99 beds	100+ beds	Other/not applicable	Total
Clinical role	Count	40	18	9	21	88
	% within facility bed numbers	85.1%	66.7%	69.2%	91.3%	80.0%
	% of Total	36.4%	16.4%	8.2%	19.1%	80.0%
Management role	Count	7	9	4	2	22
	% within facility bed numbers	14.9%	33.3%	30.8%	8.7%	20.0%
	% of Total	6.4%	8.2%	3.6%	1.8%	20.0%
Total	Count	47	27	13	23	110
	% within facility bed numbers	100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total	42.7%	24.5%	11.8%	20.9%	100.0%

χ^2=6.545[a], df=3, N=110, p=0.088, Fisher's Exact Test p=0.085
a. 2 cells (25.0%) have expected count less than 5. The minimum expected count is 2.60.

Appendix 9 Chi-squared (Goodness of Fit)

Table 7-19 *Chi-squared goodness of fit test for views reporting severe error compared with views reporting moderate error*

Formally report severe error			
	Observed N	**Expected N**	**Residual**
Always	93	74.5	18.5
Not Always	22	40.5	-18.5
Total	115		

χ^2=13.075[a], *df=1, N=115, p=0.000*
a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 40.5.

Table 7-20 *Chi-squared goodness of fit test for views reporting severe error compared with views reporting near miss error*

Formally report severe error			
	Observed N	**Expected N**	**Residual**
Always	93	52.6	40.4
Not Always	22	62.4	-40.4
Total	115		

χ^2=57.272[a], df=1, N=115, p=0.000
a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 52.6.

Table 7-21 *Chi-squared goodness of fit test for views reporting severe error compared with views of disclosure severe error*

Formally report severe error			
	Observed N	Expected N	Residual
Always	93	62.9	30.1
Not Always	22	52.1	-30.1
Total	115		

χ^2=31.745[a], df=1, N=115, p=0.000
a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 52.1.

Table 7-22 *Chi-squared goodness of fit test for views reporting moderate error compared with views reporting near miss error*

Formally report moderate error			
	Observed N	**Expected N**	**Residual**
Always	75	52.1	22.9
Not Always	39	61.9	-22.9
Total	114		

χ^2=18.513[a], df=1, N=114, p=0.000

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 52.1.

Table 7-23 *Chi-squared goodness of fit test for views reporting moderate error compared with views disclosure moderate error*

Formally report moderate error			
	Observed N	**Expected N**	**Residual**
Always	75	51.0	24.0
Not Always	39	63.0	-24.0
Total	114		

χ^2=20.386[a], df=1, N=114, p=0.000

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 51.0.

Table 7-24 *Chi-squared goodness of fit test for views reporting near miss error compared with views disclosure moderate error*

Formally report near miss error			
	Observed N	**Expected N**	**Residual**
Always	52	30.1	21.9
Not Always	62	83.9	-21.9
Total	114		

χ^2=21.618[a], df=1, N=114, p=0.000

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 30.1.

Table 7-25 *Chi-squared goodness of fit test for views disclosure severe error compared with views disclosure moderate error*

Acknowledge severe error to patient/client or family			
	Observed N	**Expected N**	**Residual**
Always	62	51.5	10.5
Not Always	53	63.5	-10.5
Total	115		

χ^2=3.895[a], *df=1, N=115, p=0.048*

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 51.5.

Table 7-26 *Chi-squared goodness of fit test for views disclosure severe error compared with views disclosure near miss error*

Acknowledge severe error to patient/client or family			
	Observed N	**Expected N**	**Residual**
Always	62	30.4	31.6
Not Always	53	84.6	-31.6
Total	115		

χ^2=44.736[a], df=1, N=115, p=0.000

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 30.4.

Table 7-27 *Chi-squared goodness of fit test for views disclosure moderate error compared with views of disclosure near miss error*

Acknowledge moderate error to patient/client or family			
	Observed N	**Expected N**	**Residual**
Always	50	29.8	20.2
Not Always	63	83.2	-20.2
Total	113		

χ^2=18.487[a], df=1, N=113, p=0.000

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 29.8.

Appendix 10 Internal consistency (based on previous UK study)

Table 7-28 *Internal Consistency (this research compared with factors determined by (Hutchinson et al., 2006)*

Factor Identified by (Hutchinson et al., 2006)	Factor α score (Hutchinson et al., 2006)	Factor α score (this study)
Teamwork Factor 1 Input into decisions and collaboration with other staff	0.84	0.68
Teamwork Factor 2 Information handover	0.69	0.67
Safety Climate Factor 1 Attitudes to safety within own team; capacity to learn from errors	0.73	0.74
Safety Climate Factor 2 Overall confidence in safety of organisation	0.70	0.51
Safety Climate Factor 3 Perceptions of management's attitudes to safety	0.78	0.85

Appendix 11 Chi-squared tables (geographical location)

Table 7-29 *Chi-squared test of teamwork and patient safety at bedside and ASGC-RA*

Teamwork and patient safety at the bedside		ASGC-RA			Total
		Outer Regional	Remote	Very Remote	
Positive	Count	68	1	0	69
	% ASGC-RA	79.1%	50.0%	0.0%	76.7%
	% of Total	75.6%	1.1%	0.0%	76.7%
Not positive	Count	18	1	2	21
	% ASGC-RA	20.9%	50.0%	100.0%	23.3%
	% of Total	20.0%	1.1%	2.2%	23.3%
Total	Count	86	2	2	90
	% ASGC-RA	100.0%	100.0%	100.0%	100.0%
	% of Total	95.6%	2.2%	2.2%	100.0%

χ^2=7.644[a], df=2, N=90, p=0.038, Fisher's Exact Test p=0.038

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .47.

Table 7-30 *Chi-squared test of teamwork and patient safety at bedside and ASGC-RA (2x2 table)*

Teamwork and patient safety at bedside		ASGC-RA Outer Regional	ASGC-RA Remote/Very Remote	Total
Positive	Count	68	1	69
	% within ASGC-RA	79.1%	25.0%	76.7%
	% of Total	75.6%	1.1%	76.7%
Not positive	Count	18	3	21
	% within ASGC-RA	20.9%	75.0%	23.3%
	% of Total	20.0%	3.3%	23.3%
Total	Count	86	4	90
	% within ASGC-RA	100.0%	100.0%	100.0%
	% of Total	95.6%	4.4%	100.0%

χ^2=3.590[b], df=1, N=90, p=0.058 [b], Phi=0.263, Fisher's Exact=0.038

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is .93.

b. Computed only for a 2x2 table

Table 7-31 *Chi-squared test of leadership and error management and ASGC-RA*

Workplace safety culture		ASGC-RA Outer Regional	ASGC-RA Remote	ASGC-RA Very Remote	Total
Positive	Count	66	0	1	67
	% ASGC-RA	70.2%	0.0%	33.3%	67.0%
	% of Total	66.0%	0.0%	1.0%	67.0%
Not positive	Count	28	3	2	33
	% ASGC-RA	29.8%	100.0%	66.7%	33.0%
	% of Total	28.0%	3.0%	2.0%	33.0%
Total	Count	94	3	3	100
	% ASGC-RA	100.0%	100.0%	100.0%	100.0%
	% of Total	94.0%	3.0%	3.0%	100.0%

χ^2=8.068[a], df=2, N=100, p=0.014, Fisher's Exact Test p=0.014

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .99.

Appendix 12 Principal Components Analysis

Table 7-32 *Total variance explained for teamwork items*

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	4.821	43.824	43.824	4.821	43.824	43.824	4.334
2	1.354	12.308	56.132	1.354	12.308	56.132	2.902
3	1.033	9.392	65.524				
4	.850	7.731	73.255				
5	.750	6.814	80.069				
6	.581	5.284	85.354				
7	.506	4.601	89.954				
8	.370	3.366	93.320				
9	.276	2.511	95.831				
10	.257	2.339	98.170				
11	.201	1.830	100.000				

Extraction Method: Principal Component Analysis.
a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.
(1=teamwork and patient safety at bedside, 2=workplace relationships and communication)

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Number of variables: 11
Number of subjects: 93
Number of replications: 50

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Eigenvalue #	Random Eigenvalue	Standard Dev
1	1.5702	.0793
2	1.3741	.0505
3	1.2628	.0449
4	1.1698	.0404
5	1.0593	.0335
6	0.9840	.0410
7	0.8954	.0305
8	0.7948	.0306
9	0.7131	.0470
10	0.6359	.0470
11	0.5405	.0471

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Monte Carlo PCA for Parallel Analysis

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Figure 7-1: Monte Carlo output teamwork items

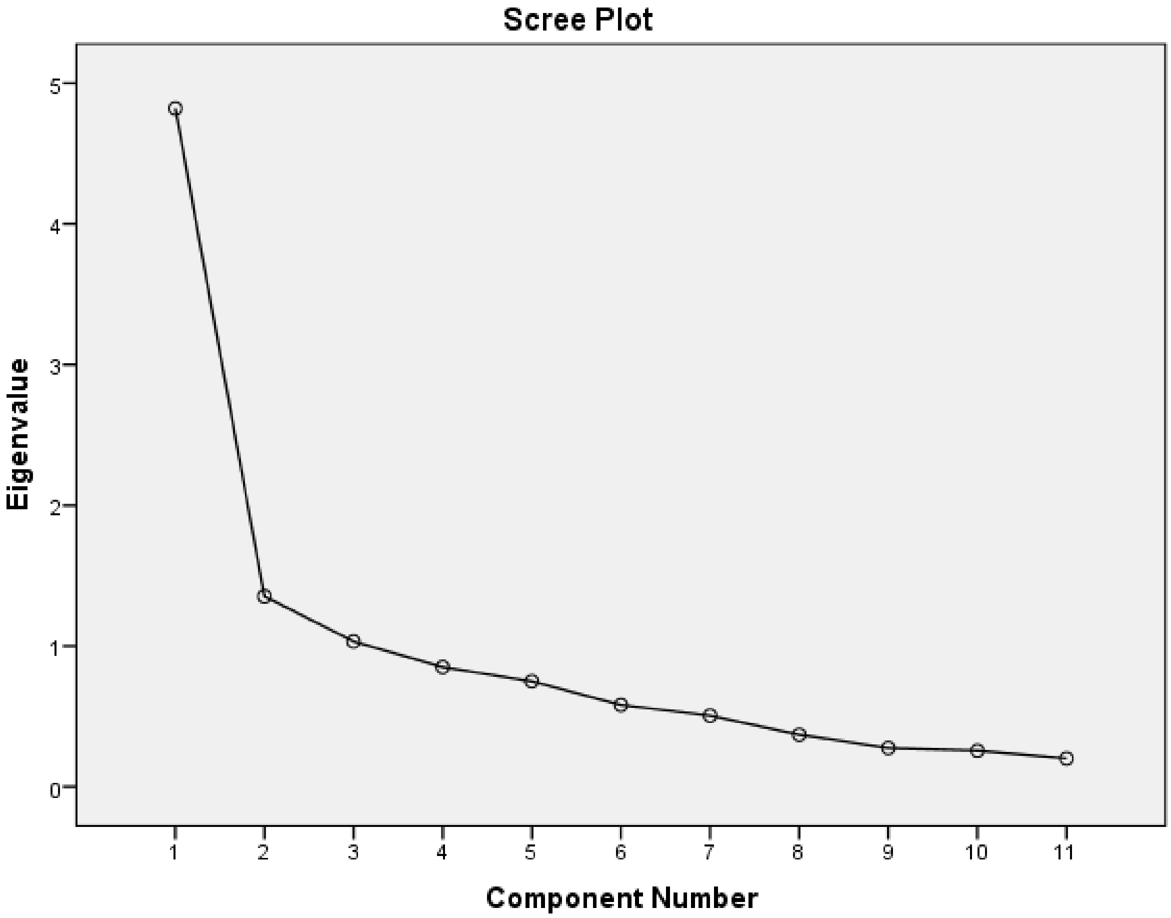

Figure 7-2: Catell's scree plot for teamwork items

Table 7-33 *Item-total statistics teamwork and patient safety at bedside*

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
1. Nurse input is well received where I work	25.3800	23.268	.564	.480	.824
2. Where I work it is difficult to speak up if I perceive a problem with patient care	25.6300	22.902	.453	.276	.843
5. Disagreements where I work are resolved appropriately (ie not who is right but what is best for the patient)	25.8800	21.440	.579	.394	.823
3. Decision making where I work uses input from relevant staff	25.5100	21.242	.666	.598	.808
8. I have the support I need from other staff to care for patients	25.3800	22.622	.608	.435	.817
10. Important issues are well communicated at shift changes	25.6000	21.717	.667	.510	.808
14. I am satisfied with the quality of collaboration that I experience with nurses where I work	25.4200	22.731	.670	.552	.810

Table 7-34 *Item-total statistics workplace relationships and communication*

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
4. The doctors and nurses here work together as a well coordinated team	13.0196	4.396	.688	.602	.494
9. I know the first and last names of all the staff I worked with during my last shift	12.4216	6.821	.208	.111	.762
12. Briefings are common where I work	13.0882	5.230	.375	.197	.703
13. I am satisfied with the quality of collaboration that I experience with senior doctors where I work	13.0588	3.818	.703	.612	.464

Table 7-35 *Total variance explained for safety climate items*

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	4.821	43.826	43.826	4.821	43.826	43.826	4.402
2	1.489	13.540	57.366	1.489	13.540	57.366	2.929
3	.970	8.815	66.181				
4	.723	6.573	72.754				
5	.661	6.010	78.764				
6	.620	5.633	84.396				
7	.594	5.400	89.797				
8	.329	2.989	92.785				
9	.312	2.834	95.619				
10	.301	2.737	98.356				
11	.181	1.644	100.000				

Extraction Method: Principal Component Analysis.
a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.
(1=leadership and error management, 2=workplace safety culture)

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Number of variables: 11
Number of subjects: 104
Number of replications: 50

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Eigenvalue #	Random Eigenvalue	Standard Dev
1	1.5532	.1064
2	1.3960	.0423
3	1.2724	.0508
4	1.1416	.0340
5	1.0698	.0514
6	0.9778	.0448
7	0.8982	.0349
8	0.8070	.0416
9	0.7151	.0302
10	0.6233	.0501
11	0.5456	.0456

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Figure 7-3: Monte Carlo output safety climate items

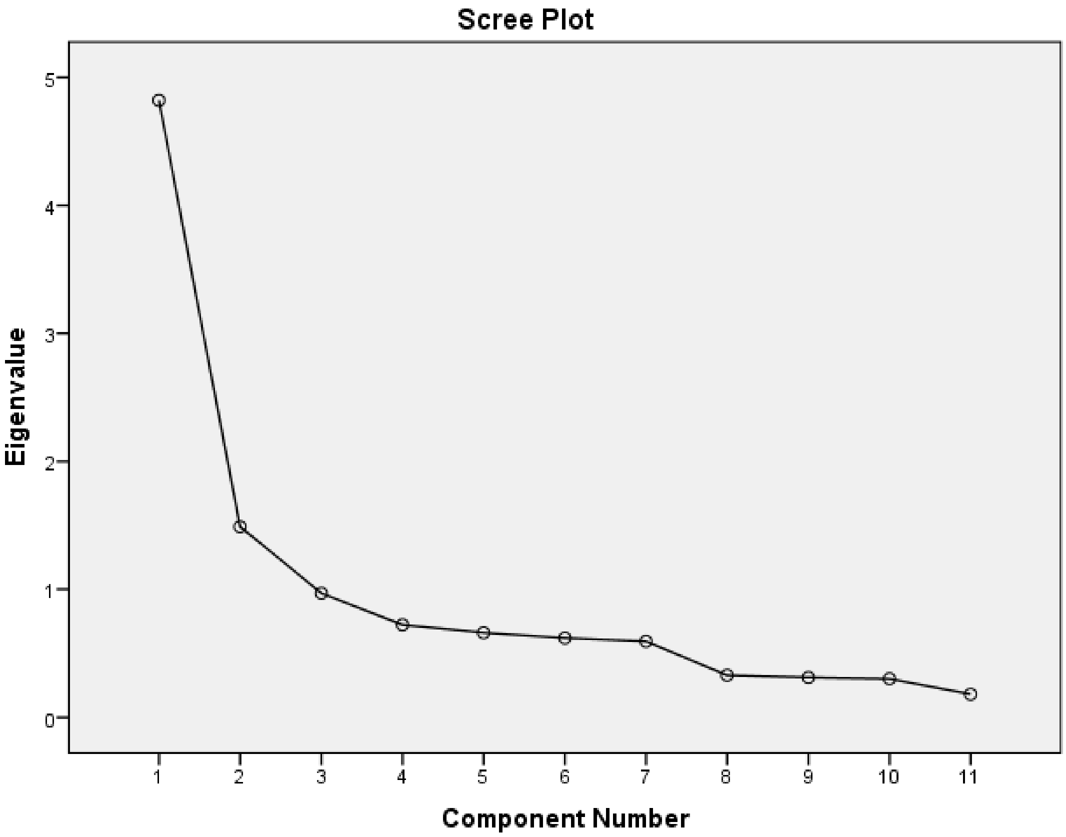

Figure 7-4: Catell's scree test safety climate items

Table 7-36 *Item-total statistics workplace safety culture*

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
15. The levels of staffing where I work are sufficient to handle the number of patients	12.5586	5.558	.581	.428	.623
16. I would feel safe being treated as a patient in this service	11.7568	7.058	.608	.451	.611
17. I am encouraged by my colleagues to report any patient safety concerns I may have	11.4685	8.415	.481	.267	.690
19. The culture where I work makes it easy to learn from the errors of others	12.3514	6.885	.444	.227	.705

Table 7-37 *Item-total statistics leadership and error management*

Item-Total Statistics					
	Scale Mean if Item Deleted	**Scale Variance if Item Deleted**	**Corrected Item-Total Correlation**	**Squared Multiple Correlation**	**Cronbach's Alpha if Item Deleted**
20. I receive appropriate feedback about my performance	24.9720	24.801	.603	.444	.836
21. Medical errors are handled appropriately here	24.4860	25.328	.731	.588	.816
22. I know the proper channels to which I should direct questions regarding patient safety	23.8598	32.480	.410	.221	.862
24. Management does not knowingly compromise the safety of patients	24.4860	26.026	.525	.328	.848
25. This organisation is doing more for patient safety than it did one year ago	24.9439	26.261	.553	.394	.842
26. Leadership is driving us to be a safety centred organisation	24.7009	24.155	.786	.699	.806
27. My suggestions about safety would be acted upon if I expressed them to management	24.5888	23.848	.785	.692	.805

Appendix 13 Standards of good practice

Criteria	Summary of application in this thesis
Before the analytic moment	
1. QCA should be used for its original aims	QCA is being used in this thesis to describe the case-based data and assist meet the research aim to *describe the complexity of safety culture of nurses working in rural clinical settings* and for theory development (Sections 6.3 and 6.4)
2. QCA should be applied together with other data analysis techniques in a research project	Statistical analysis (inferential statistics and principal components analysis) is being used alongside QCA for this thesis (Sections 4.3 and 4.4)
3. Familiarity with cases is a requirement before, during, and after the analytical moment of a QCA	The cases for the research are the nurses working in rural clinical settings. Familiarity with the cases has been undertaken through review of the literature as well as the QCA analysis process. The possible outcomes from the QCA analysis are informed from the statistical analysis that has been undertaken (Sections 4.3.3 and 5.6)
4. There should always be an explicit and detailed justification for the(non-) selection of cases	All cases have been included in the QCA process.
5. The number of conditions should be kept at a moderate level	The number of conditions has been determined by the Exploratory Factor Analysis using Principle Components Analysis. This process has been based upon a previous study {Hutchinson, 2006 #221}. Hence the use of safety climate and teamwork factors was identified in the research design but the final approach taken has been determined by the statistical analysis of the data obtained for this study (Sections 4.3.3 and 5.6).
6. The conditions and outcome should be selected and conceptualised on the basis of adequate prior theoretical knowledge as well as empirical insights gained throughout the research process	The research design incorporated the conditions and the outcome that have been selected. The need to consider these has been outlined in the literature review (Chapter 2, Part II) This process informed the use of existing tools from previous studies {Hutchinson, 2006 #221;Weissman, 2005 #211;Sexton, 2006 #222} to increase transparency. The statistical analysis has also informed the choice of conditions (Sections 4.3.3 and 5.6)
7. The calibration of set membership scores should be discussed in detail	Please refer to Section 4.2.2).
8. The appropriate QCA terminology should be followed	Terminology and algebra as used by Schneider and Wagemann (2012).
During the analytic moment	
9. Necessary and sufficient conditions should be analysed in separate analytical steps with the analysis of necessary conditions undertaken first	fsQCA and Kirq software has been used to undertake the analysis of necessary and sufficient conditions. These results appear in Chapter 5 Part II and Appendix 16, 17 and 19.

10. Contradictory truth table rows should be resolved prior to minimising the truth table algorithm	This has been undertaken in Sections 4.8.1, 5.13 and 5.14
11. Truth tables should be minimised with the help of appropriate computer software	fsQCA software has been used to minimise the truth tables.
12. The choice of appropriate levels of consistency and coverage are research-specific and need to be supported with arguments	Please refer to Sections 4.8.3 and 5.14
13. The treatment of inconsistent truth table rows (in fsQCA) in the logical minimisation process should be transparent	Please refer to Sections 4.8.3 and 5.14
14. The treatment of logical remainders should be transparent	Please refer to Section 4.8.4
15. Based on one truth table, several solution formulas of different complexity should be produced and presented	Solution terms presented are complex/intermediate terms except in Section 5.13.2 which presents all solutions. .
16. The outcome and the negation of the outcome should always be dealt with in two separate analyses	Analysis of negated sets appears in Section 5.15.2Relevant truth tables appear in Appendix 17 and 19.
After the analytic moment	
17. Different presentational forms of QCA results should be used in order to depict both the case- and variable- oriented aspects of QCA	Two methods of presentation have been undertaken. Solution term tables are presented in Section 5.13 and 5.14. Matrix tables comparing configurational rows appear in Sections 5.13 and 5.15.
18. QCA should always be related back to the cases rather than being applied in a mechanical way	This has been undertaken in Section 5.17 and Chapter 6.
19. Solution formulas should be linked back to the cases, preferably through graphical representation tools	As above
20. Individual conditions of a conjunctural and equifinal solution term should not be (over)interpreted	As above
21. The researcher should always provide explicit justification when one (or more) of the paths towards an outcome is deemed more important than others	As above
22. Solution formula alone should not be taken as demonstrating an underlying causal relationship between the conditions and an outcome	As above. Please see Sections 6.2 to 6.6 in particular
23. The raw data matrix should be published	Raw data appears in Appendix 14 and the calibrated data may be seen in Appendix 15.
24. The truth table should be reported	Truth tables appear in Section 5.13.2 as well as Appendix 18 and Appendix 19
25. Every QCA must contain the solution formula(s)	These appear in the Section 5.13.2 and Section 5.14.
26. The consistency and coverage measures should always be reported	These appear Section 5.14.

(Based upon Schneider & Wagemann 2010)

Appendix 14 Raw data table

Case ID	Score TF1	Score TF2	Score SCF1	Score SCF2	Report Severe	Disclose Severe	Report Moderate	Disclose Moderate	Report Near Miss	Disclose Near Miss
1	96.43	93.75	93.75	89.29	Always	Rarely	Always	Sometimes	Always	Sometimes
2	100.00	87.50	100.00	100.00	Always	Always	Always	Always	Always	Usually
3	96.43	100.00	100.00	92.86	Always	Always	Usually	Usually	Usually	Usually
4	85.71	93.75	81.25	82.14	Always	Usually	Always	Usually	Usually	Sometimes
5	71.43	93.75	62.50	42.86	Always	Always	Never	Never	Never	Never
6	96.43	87.50	87.50	96.43	Always	Always	Always	Always	Always	Always
7	89.29	81.25	100.00	67.86	Always	Always	Always	Always	Always	Usually
8	100.00	100.00	100.00	85.71	Always	Always	Always	Always	Always	Always
9	89.29	93.75	75.00	89.29	Rarely	Rarely	Rarely	Usually	Always	Usually
10	100.00	100.00	56.25	57.14	Always	Always	Always	Always	Always	Always
11	96.43	87.50	100.00	100.00	Always	Always	Always	Always	Always	Always
12	96.43	87.50	81.25	96.43	Always	Always	Always	Always	Always	Always
13	89.29	87.50	81.25	75.00	Always	Usually	Always	Always	Usually	Usually
14	67.86	81.25	56.25	57.14	Always	Always	Always	Always	Always	Always
15	85.71	75.00	87.50	96.43	Always	Always	Always	Always	Always	Always
16	39.29	81.25	12.50	28.57	Always	Never	Always	Never	Sometimes	Never
17	85.71	68.75	81.25	75.00	Always	Always	Usually	Usually	Usually	Usually

18	100.00	100.00	75.00	96.43	Always	Always	Usually	Usually	Usually	Usually
19	92.86	81.25	81.25	78.57	Always	Always	Always	Always	Always	Always
20	100.00	81.25	100.00	100.00	Always	Rarely	Always	Rarely	Always	Rarely
21	67.86	56.25	75.00	82.14	Always	Always	Always	Always	Always	Always
22	100.00	100.00	68.75	92.86	Always	Always	Always	Always	Always	Never
23	50.00	81.25	31.25	28.57	Usually	Rarely	Usually	Sometimes	Rarely	Rarely
24	96.43	93.75	81.25	89.29	Always	Usually	Always	Usually	Always	Usually
25	78.57	93.75	81.25	57.14	Always	Usually	Always	Usually	Always	Usually
26	100.00	100.00	93.75	82.14	Always	Always	Always	Always	Sometimes	Sometimes
27	64.29	37.50	87.50	85.71	Always	Always	Always	Always	Always	Sometimes
28	67.86	100.00	87.50	100.00	Always	Usually	Usually	Usually	Usually	Rarely
29	85.71	100.00	100.00	100.00	Always	Always	Always	Always	Always	Always
30	100.00	87.50	87.50	100.00	Always	Always	Always	Always	Usually	Always
31	85.71	100.00	87.50	78.57	Always	Always	Always	Always	Always	Usually
32	92.86	100.00	68.75	78.57	Usually	Usually	Usually	Usually	Usually	Usually
33	35.71	87.50	81.25	50.00	Always	Always	Always	Always	Always	Always
34	100.00	93.75	100.00	78.57	Always	Usually	Always	Usually	Always	Usually
35	100.00	100.00	100.00	82.14	Always	Never	Always	Never	Always	Always
36	60.71	75.00	81.25	75.00	Always	Usually	Always	Usually	Always	Sometimes
37	100.00	100.00	100.00	96.43	Always	Usually	Usually	Usually	Rarely	Rarely
38	89.29	75.00	81.25	96.43	Always	Always	Always	Always	Usually	Usually
39	25.00	93.75	56.25	14.29	Always	Always	Always	Always	Always	Always
40	75.00	37.50	81.25	92.86	Sometimes	Sometimes	Usually	Sometimes	Never	Never

41	78.57	68.75	50.00	75.00	Always	Always	Always	Always	Always	Usually
42	64.29	87.50	56.25	75.00	Always	Always	Always	Usually	Usually	Usually
43	82.14	81.25	56.25	89.29	Always	Usually	Always	Usually	Sometimes	Rarely
44	71.43	75.00	87.50	75.00	Always	Always	Always	Always	Always	Sometimes
45	85.71	68.75	75.00	71.43	Always	Always	Always	Always	Sometimes	Usually
46	100.00	93.75	87.50	100.00	Never	Never	Rarely	Rarely	Rarely	Rarely
47	100.00	81.25	100.00	92.86	Always	Usually	Usually	Usually	Sometimes	Rarely
48	85.71	100.00	43.75	89.29	Always	Always	Always	Always	Always	Always
49	67.86	43.75	43.75	67.86	Always	Always	Always	Usually	Usually	Sometimes
50	82.14	68.75	81.25	64.29	Always	Always	Always	Sometimes	Sometimes	Rarely
51	100.00	93.75	100.00	75.00	Always	Always	Always	Always	Always	Usually
52	100.00	93.75	68.75	100.00	Rarely	Rarely	Rarely	Rarely	Rarely	Rarely
53	64.29	87.50	56.25	82.14	Always	Always	Always	Always	Always	Always
54	96.43	100.00	93.75	92.86	Always	Usually	Always	Usually	Usually	Usually
55	96.43	93.75	100.00	92.86	Never	Usually	Rarely	Usually	Rarely	Usually
56	85.71	75.00	75.00	89.29	Always	Usually	Always	Usually	Usually	Usually
57	85.71	81.25	87.50	96.43	Rarely	Usually	Rarely	Usually	Rarely	Sometimes
58	96.43	75.00	75.00	67.86	Always	Always	Rarely	Usually	Rarely	Sometimes
59	100.00	93.75	100.00	100.00	Always	Usually	Sometimes	Sometimes	Sometimes	Rarely
60	42.86	25.00	43.75	64.29	Always	Always	Always	Always	Always	Always
61	96.43	87.50	81.25	89.29	Always	Always	Always	Usually	Sometimes	Sometimes
62	67.86	81.25	68.75	75.00	Never	Never	Usually	Usually	Usually	Usually
63	75.00	50.00	62.50	46.43	Usually	Usually	Usually	Usually	Sometimes	Sometimes

64	82.14	68.75	81.25	85.71	Always	Usually	Always	Usually	Always	Usually
65	75.00	81.25	62.50	71.43	Always	Always	Usually	Always	Sometimes	Sometimes
66	67.86	81.25	62.50	75.00	Always	Always	Usually	Usually	Rarely	Rarely
67	100.00	100.00	93.75	85.71	Always	Always	Always	Always	Sometimes	Always
68	89.29	93.75	87.50	100.00	Always	Always	Always	Always	Always	Sometimes
69	96.43	100.00	75.00	92.86	Always	Always	Always	Always	Usually	Usually
70	89.29	93.75	87.50	92.86	Always	Usually	Always	Usually	Always	Usually
71	92.86	87.50	81.25	75.00	Always	Always	Sometimes	Sometimes	Rarely	Rarely
72	64.29	68.75	68.75	53.57	Never	Never	Usually	Usually	Usually	Usually
73	100.00	93.75	100.00	96.43	Always	Always	Always	Always	Always	Usually
74	96.43	87.50	100.00	96.43	Always	Always	Always	Always	Always	Always
75	53.57	31.25	31.25	71.43	Always	Sometimes	Always	Sometimes	Always	Rarely
76	100.00	93.75	81.25	100.00	Always	Always	Always	Always	Always	Always
77	67.86	87.50	75.00	75.00	Always	Always	Always	Usually	Usually	Usually
78	82.14	100.00	68.75	46.43	Always	Usually	Always	Usually	Sometimes	Sometimes
79	64.29	81.25	75.00	85.71	Never	Rarely	Rarely	Rarely	Never	Rarely
80	46.43	62.50	75.00	32.14	Never	Usually	Usually	Usually	Always	Usually
81	53.57	87.50	37.50	39.29	Always	Usually	Always	Usually	Usually	Sometimes
82	85.71	93.75	100.00	39.29	Always	Always	Always	Always	Always	Always
83	85.71	62.50	56.25	96.43	Always	Always	Always	Always	Always	Always
84	96.43	93.75	93.75	78.57	Always	Always	Always	Always	Usually	Usually
85	82.14	62.50	75.00	85.71	Always	Always	Usually	Always	Usually	Usually

Appendix 15 Calibrated Data Table

Case ID	tf1	tf2	scf1	scf2	sr	sd	mr	md	nmr	nmd	rh	racf	rc	mx
1	1	1	1	1	1	0.15	1	0.3	1	0.3	0	0	0	1
2	1	1	1	1	1	1	1	1	1	0.45	1	0	0	1
3	1	1	1	1	1	1	0.45	0.45	0.45	0.45	0	0	1	0
4	1	1	1	1	1	0.45	1	0.45	0.45	0.3	1	0	0	0
5	0.49	1	0.49	0.25	1	1	0	0	0	0	1	0	0	0
6	1	1	1	1	1	1	1	1	1	1	0	1	0	1
7	1	1	1	0.49	1	1	1	1	1	0.45	1	0	0	0
8	1	1	1	1	1	1	1	1	1	1	1	0	0	1
9	1	1	1	1	0.15	0.15	0.15	0.45	1	0.45	0	0	1	0
10	1	1	0.49	0.49	1	1	1	1	1	1	0	0	0	0
11	1	1	1	1	1	1	1	1	1	1	1	0	0	1
12	1	1	1	1	1	1	1	1	1	1	0	1	0	1
13	1	1	1	1	1	0.45	1	1	0.45	0.45	1	0	0	0
14	0.49	1	0.49	0.49	1	1	1	1	1	1	1	0	0	0
15	1	1	1	1	1	1	1	1	1	1	0	1	0	0
16	0.25	1	0	0.25	1	0	1	0	0.3	0	0	0	1	0
17	1	0.49	1	1	1	1	0.45	0.45	0.45	0.45	1	0	0	1
18	1	1	1	1	1	1	0.45	0.45	0.45	0.45	0	1	0	1

19	1	1	1	1	1	1	1	1	1	1	1	0	0	0
20	1	1	1	1	1	0.15	1	0.15	1	0.15	0	0	1	0
21	0.49	0.49	1	1	1	1	1	1	1	1	0	0	1	0
22	1	1	0.49	1	1	1	1	1	1	0	1	0	0	0
23	0.49	1	0.25	0.25	0.45	0.15	0.45	0.3	0.15	0.15	1	0	0	0
24	1	1	1	1	1	0.45	1	0.45	1	0.45	1	0	0	0
25	1	1	1	0.49	1	0.45	1	0.45	1	0.45	1	0	0	0
26	1	1	1	1	1	1	1	1	0.3	0.3	0	1	0	1
27	0.49	0.25	1	1	1	1	1	1	1	0.3	1	0	0	0
28	0.49	1	1	1	1	0.45	0.45	0.45	0.45	0.15	1	0	0	0
29	1	1	1	1	1	1	1	1	1	1	0	1	0	0
30	1	1	1	1	1	1	1	1	0.45	1	0	1	0	1
31	1	1	1	1	1	1	1	1	1	0.45	1	0	0	0
32	1	1	0.49	1	0.45	0.45	0.45	0.45	0.45	0.45	1	0	0	0
33	0.25	1	1	0.49	1	1	1	1	1	1	0	1	0	0
34	1	1	1	1	1	0.45	1	0.45	1	0.45	0	1	0	0
35	1	1	1	1	1	0	1	0	1	1	0	0	1	0
36	0.49	1	1	1	1	0.45	1	0.45	1	0.3	1	0	0	0
37	1	1	1	1	1	0.45	0.45	0.45	0.15	0.15	0	0	1	0
38	1	1	1	1	1	1	1	1	0.45	0.45	1	0	0	0
39	0	1	0.49	0	1	1	1	1	1	1	0	1	0	0
40	1	0.25	1	1	0.3	0.3	0.45	0.3	0	0	1	0	0	0
41	1	0.49	0.49	1	1	1	1	1	1	0.45	0	0	1	0

42	0.49	1	0.49	1	1	1	1	0.45	0.45	0.45	1	0	0	0
43	1	1	0.49	1	1	0.45	1	0.45	0.3	0.15	1	0	0	0
44	0.49	1	1	1	1	1	1	1	1	0.3	0	1	0	0
45	1	0.49	1	0.49	1	1	1	1	0.3	0.45	0	1	0	0
46	1	1	1	1	0	0	0.15	0.15	0.15	0.15	0	0	1	0
47	1	1	1	1	1	0.45	0.45	0.45	0.3	0.15	1	0	0	0
48	1	1	0.25	1	1	1	1	1	1	1	0	1	0	1
49	0.49	0.25	0.25	0.49	1	1	1	0.45	0.45	0.3	1	0	0	0
50	1	0.49	1	0.49	1	1	1	0.3	0.3	0.15	1	0	0	0
51	1	1	1	1	1	1	1	1	1	0.45	1	0	0	0
52	1	1	0.49	1	0.15	0.15	0.15	0.15	0.15	0.15	1	0	0	0
53	0.49	1	0.49	1	1	1	1	1	1	1	0	1	0	0
54	1	1	1	1	1	0.45	1	0.45	0.45	0.45	1	0	0	1
55	1	1	1	1	0	0.45	0.15	0.45	0.15	0.45	0	0	1	1
56	1	1	1	1	1	0.45	1	0.45	0.45	0.45	1	0	0	0
57	1	1	1	1	0.15	0.45	0.15	0.45	0.15	0.3	1	0	0	0
58	1	1	1	0.49	1	1	0.15	0.45	0.15	0.3	0	1	0	1
59	1	1	1	1	1	0.45	0.3	0.3	0.3	0.15	0	0	1	0
60	0.25	0	0.25	0.49	1	1	1	1	1	1	0	1	0	0
61	1	1	1	1	1	1	1	0.45	0.3	0.3	1	0	0	0
62	0.49	1	0.49	1	0	0	0.45	0.45	0.45	0.45	1	0	0	0
63	1	0.49	0.49	0.25	0.45	0.45	0.45	0.45	0.3	0.3	1	0	0	0
64	1	0.49	1	1	1	0.45	1	0.45	1	0.45	0	0	1	0

65	1	1	0.49	0.49	1	1	0.45	1	0.3	0.3	1	0	0	0
66	0.49	1	0.49	1	1	1	0.45	0.45	0.15	0.15	1	0	0	0
67	1	1	1	1	1	1	1	1	0.3	1	0	1	0	0
68	1	1	1	1	1	1	1	1	1	0.3	1	0	0	0
69	1	1	1	1	1	1	1	1	0.45	0.45	1	0	0	0
70	1	1	1	1	1	0.45	1	0.45	1	0.45	1	0	0	0
71	1	1	1	1	1	1	0.3	0.3	0.15	0.15	1	0	0	1
72	0.49	0.49	0.49	0.49	0	0	0.45	0.45	0.45	0.45	0	0	1	0
73	1	1	1	1	1	1	1	1	1	0.45	0	0	1	0
74	1	1	1	1	1	1	1	1	1	1	0	1	0	0
75	0.49	0.25	0.25	0.49	1	0.3	1	0.3	1	0.15	0	1	0	0
76	1	1	1	1	1	1	1	1	1	1	0	1	0	0
77	0.49	1	1	1	1	1	1	0.45	0.45	0.45	1	0	0	0
78	1	1	0.49	0.25	1	0.45	1	0.45	0.3	0.3	0	0	0	0
79	0.49	1	1	1	0	0.15	0.15	0.15	0	0.15	1	0	0	0
80	0.25	0.49	1	0.25	0	0.45	0.45	0.45	1	0.45	0	0	1	0
81	0.49	1	0.25	0.25	1	0.45	1	0.45	0.45	0.3	1	0	0	0
82	1	1	1	0.25	1	1	1	1	1	1	0	0	1	0
83	1	0.49	0.49	1	1	1	1	1	1	1	1	0	0	1
84	1	1	1	1	1	1	1	1	0.45	0.45	0	0	0	0
85	1	0.49	1	1	1	1	0.45	1	0.45	0.45	1	0	0	0

Appendix 16 Necessary conditions

Views of reporting – necessary conditions

Analysis of Necessary Conditions

Outcome variable: sr

Conditions tested:

	Consistency	Coverage
tf1	0.875731	0.896825
~tf1	0.133787	0.746586
tf2	0.904555	0.882478
~tf2	0.101564	0.777315
scf1	0.843100	0.881826
~scf1	0.173895	0.871253
scf2	0.870156	0.896735
~scf2	0.142760	0.770359
rh	0.525493	0.858889
~rh	0.474507	0.872500
racf	0.241332	0.887500
~racf	0.758668	0.858462
rc	0.178790	0.821875
~rc	0.821210	0.875362
mx	0.203943	0.937500
~mx	0.796057	0.848551

Analysis of Necessary Conditions

Outcome variable: ~sr

Conditions tested:

	Consistency	Coverage
tf1	0.708297	0.112921
~tf1	0.352838	0.306525
tf2	0.813100	0.123491
~tf2	0.226201	0.269511
scf1	0.834935	0.135950
~scf1	0.274236	0.213896
scf2	0.726638	0.116576
~scf2	0.356332	0.299340
racf	0.048035	0.026190
rh	0.554585	0.141111
~rh	0.445415	0.127500

racf	0.196507	0.112500
~racf	0.803493	0.141538
rc	0.248908	0.178125
~rc	0.751092	0.124638
mx	0.087336	0.062500
~mx	0.912664	0.151449

Analysis of Necessary Conditions

Outcome variable: mr

Conditions tested:

	Consistency	Coverage
tf1	0.891288	0.833333
~tf1	0.158600	0.808042
tf2	0.912881	0.813105
~tf2	0.122859	0.858481
scf1	0.853164	0.814704
~scf1	0.194490	0.889646
scf2	0.878928	0.826958
~scf2	0.156813	0.772561
rh	0.499628	0.745556
~rh	0.500372	0.840000
racf	0.247952	0.832500
~racf	0.752048	0.776923
rc	0.192852	0.809375
~rc	0.807148	0.785507
mx	0.188384	0.790625
~mx	0.811616	0.789855

Analysis of Necessary Conditions

Outcome variable: ~mr

Conditions tested:

	Consistency	Coverage
tf1	0.858263	0.213311
~tf1	0.329412	0.446130
tf2	0.923810	0.218729
~tf2	0.210644	0.391259
scf1	0.909244	0.230802
~scf1	0.270028	0.328338
scf2	0.826331	0.206669
~scf2	0.308123	0.403522
rh	0.641457	0.254444
~rh	0.358543	0.160000
racf	0.187675	0.167500
~racf	0.812325	0.223077
rc	0.170868	0.190625
~rc	0.829132	0.214493
mx	0.187675	0.209375
~mx	0.812325	0.210145

Analysis of Necessary Conditions

Outcome variable: nmr

Conditions tested:

	Consistency	Coverage
tf1	0.933641	0.703286
~tf1	0.148614	0.610015
tf2	0.907578	0.651280
~tf2	0.138632	0.780437
scf1	0.906284	0.697241
~scf1	0.171349	0.631471
scf2	0.899815	0.682079
~scf2	0.151941	0.603081
rh	0.502773	0.604444
~rh	0.497227	0.672500
racf	0.227357	0.615000
~racf	0.772643	0.643077
rc	0.219039	0.740625
~rc	0.780961	0.612319
mx	0.187615	0.634375
~mx	0.812384	0.636957

Analysis of Necessary Conditions

Outcome variable: ~nmr

Conditions tested:

	Consistency	Coverage
tf1	0.833657	0.358674
~tf1	0.310356	0.727618
tf2	0.931715	0.381881
~tf2	0.149191	0.479709
scf1	0.824919	0.362486
~scf1	0.311003	0.654632
scf2	0.824919	0.357153
~scf2	0.265696	0.602348
rh	0.576052	0.395556
~rh	0.423948	0.327500
racf	0.249191	0.385000
~racf	0.750809	0.356923
rc	0.134304	0.259375
~rc	0.865696	0.387681
mx	0.189320	0.365625
~mx	0.810680	0.363043

Views of disclosure

Analysis of Necessary Conditions

Outcome variable: sd

Conditions tested:

	Consistency	Coverage
tf1	0.921057	0.776525
~tf1	0.136746	0.628225
tf2	0.909001	0.730070
~tf2	0.117424	0.739854
scf1	0.878447	0.756399
~scf1	0.169447	0.698910
scf2	0.906523	0.769091
~scf2	0.142196	0.631695
rh	0.566474	0.762222
~rh	0.433526	0.656250
racf	0.232865	0.705000
~racf	0.767134	0.714615
rc	0.157721	0.596875
~rc	0.842279	0.739130
mx	0.222956	0.843750
~mx	0.777044	0.681884

Analysis of Necessary Conditions

Outcome variable: ~sd

Conditions tested:

	Consistency	Coverage
tf1	0.799591	0.272208
~tf1	0.343558	0.637329
tf2	0.897751	0.291153
~tf2	0.167689	0.426639
scf1	0.819223	0.284841
~scf1	0.299387	0.498638
scf2	0.794683	0.272243
~scf2	0.325971	0.584740
rh	0.437628	0.237778
~rh	0.562372	0.343750
racf	0.241309	0.295000
~racf	0.758691	0.285385
rc	0.263804	0.403125
~rc	0.736196	0.260870
mx	0.102249	0.156250
~mx	0.897751	0.318116

Analysis of Necessary Conditions

Outcome variable: md

Conditions tested:

	Consistency	Coverage
tf1	0.949639	0.732526
~tf1	0.155957	0.655539
tf2	0.928881	0.682584
~tf2	0.131588	0.758585
scf1	0.915523	0.721274
~scf1	0.181949	0.686648
scf2	0.919675	0.713885
~scf2	0.151625	0.616288
rh	0.546931	0.673333
~rh	0.453068	0.627500
racf	0.237365	0.657500
~racf	0.762635	0.650000
rc	0.166065	0.575000
~rc	0.833935	0.669565
mx	0.201263	0.696875
~mx	0.798736	0.641304

Analysis of Necessary Conditions

Outcome variable: ~md

Conditions tested:

	Consistency	Coverage
tf1	0.846622	0.348928
~tf1	0.351014	0.788316
tf2	0.921622	0.361852
~tf2	0.191554	0.590010
scf1	0.844595	0.355518
~scf1	0.337838	0.681199
scf2	0.823311	0.341460
~scf2	0.310135	0.673514
rh	0.496622	0.326667
~rh	0.503378	0.372500
racf	0.231419	0.342500
~racf	0.768581	0.350000
rc	0.229730	0.425000
~rc	0.770270	0.330435
mx	0.163851	0.303125
~mx	0.836149	0.358696

Analysis of Necessary Conditions

Outcome variable: nmd

Conditions tested:

	Consistency	Coverage
tf1	0.966029	0.562239
~tf1	0.146411	0.464340
tf2	0.966029	0.535615
~tf2	0.139234	0.605619
scf1	0.936603	0.556741
~scf1	0.168660	0.480245
scf2	0.949282	0.555976
~scf2	0.157177	0.482025
rh	0.480861	0.446667
~rh	0.519139	0.542500
racf	0.287081	0.600000
~racf	0.712919	0.458462
rc	0.183014	0.478125
~rc	0.816986	0.494928
mx	0.226077	0.590625
~mx	0.773923	0.468841

Analysis of Necessary Conditions

Outcome variable: ~nmd

Conditions tested:

	Consistency	Coverage
tf1	0.836574	0.503202
~tf1	0.272222	0.892261
tf2	0.912269	0.522748
~tf2	0.189583	0.852237
scf1	0.823380	0.505830
~scf1	0.278472	0.819482
scf2	0.836574	0.506375
~scf2	0.266435	0.844461
rh	0.576389	0.553333
~rh	0.423611	0.457500
racf	0.185185	0.400000
~racf	0.814815	0.541538
rc	0.193287	0.521875
~rc	0.806713	0.505072
mx	0.151620	0.409375
~mx	0.848380	0.531159

Appendix 17 Truth tables factors and views

Table 7-38 *Truth table views of reporting moderate error*

tf1	tf2	scf1	scf2	No	mr	raw consist.	PRI consist.	Product	Cases consistent with row	Cases inconsistent with row
1	0	0	1	2		0.986622	0.980392	0.980392	41;83	
0	0	1	1	2		0.984064	0.974359	0.974359	21;27;	
1	1	0	1	5		0.957688	0.944520	0.94452	22; 32;43;48; 52;	
1	0	0	0	1		0.955157	0.907407	0.907407		63
0	0	1	0	1		0.942857	0.833333	0.833333		80
1	0	1	1	4		0.928161	0.893843	0.893843	40;64;	17;85
0	1	0	1	4		0.909292	0.859589	0.859589	42;53;	66;62
0	1	1	1	5		0.896594	0.840225	0.840226	77; 44	28;36;79
1	1	0	0	3		0.871647	0.804094	0.804094	78;10	65
0	0	0	0	4		0.867647	0.790698	0.790698	49;75	60;72
1	1	1	0	4		0.858364	0.803056	0.803056	25;82;7	58
1	0	1	0	2		0.853333	0.696552	0.696552	50	45
1	1	1	1	41		0.851820	0.828782	0.878698	1; 2; 4; 6; 8; 11;12; 13;15; 19; 20;24; 26;29; 30;34;35; 37;38;47;55; 59; 61; 67;68;69;70; 73;74;76;84	3;9;18;31;46;51; 54;56;57;71
0	1	1	0	1		0.845960	0.741525	0.741525	33	
0	1	0	0	6		0.843823	0.772109	0.772109	14;16; 81	5; 23; 39
0	0	0	1	0						

Table 7-39 *Truth table views of reporting near miss error*

tf1	tf2	scf 1	scf 2	No	nmr	raw consist.	PRI consist.	Product	Cases consistent with row	Cases inconsistent with row
0	0	1	1	2		0.944223	0.915663	0.915663	21;27	
0	0	1	0	1		0.920000	0.844444	0.844444	80	
1	0	1	1	4		0.908046	0.853211	0.853211	40;64	17;85
1	0	0	1	2		0.869565	0.719424	0.719424	83	41
1	1	0	1	5		0.842105	0.710775	0.738703	22;32;43;52	48
1	1	1	0	4		0.786325	0.695122	0.695122	7;25;82	58
1	0	1	0	2		0.770000	0.594118	0.594118	50	45
0	1	0	1	4		0.761062	0.406593	0.406593		42;53;62;66
1	0	0	0	1		0.757847	0.475728	0.475728		63
1	1	1	1	41		0.732793	0.654781	0.764706	1;2;6;8;9;11;12;15;19;20;24; 29;34;35;38;47;59;68;70;73; 74;76	3;4;13;18;26;30 31;37;46;51;54; 55; 56;57;61;67;69;71 84;
0	1	1	1	5		0.732360	0.502262	0.502262		28;36;44;79;77
0	1	1	0	1		0.717172	0.608392	0.608392	33	
1	1	0	0	3		0.708812	0.451263	0.451263	10	65;78
0	0	0	0	4		0.691176	0.447368	0.447368	75	49;60;72
0	1	0	0	6		0.550117	0.282528	0.287879	14	5; 16;23;39;81
0	0	0	1	0						

Table 7-40 *Truth table views of reporting severe error (negated)*

tf1	tf2	scf 1	scf 2	No	~sr	raw consist.	PRI consist.	Product
0	0	1	0	1		0.714286	0.666667	0.666667
1	0	1	0	2		0.663333	0.560870	0.560870
1	0	0	0	1		0.560538	0.359477	0.359477
0	0	0	0	4		0.500000	0.358491	0.358491
0	1	1	0	1		0.434343	0.343108	0.343109
0	0	1	1	2		0.394422	0.327434	0.327434
0	1	0	0	6		0.351981	0.214689	0.214689
1	0	0	1	2		0.331104	0.196787	0.196787
1	1	0	0	3		0.281609	0.131944	0.131944
0	1	0	1	4		0.276549	0.234192	0.234192
1	0	1	1	4		0.248563	0.190402	0.190402
0	1	1	1	5		0.242092	0.218319	0.218319
1	1	1	0	4		0.240537	0.169559	0.169559
1	1	0	1	5		0.152735	0.106638	0.106638
1	1	1	1	41		0.117475	0.095634	0.097180
0	0	0	1	0				

Table 7-41 *Truth table views of reporting moderate error (negated)*

tf1	tf2	scf 1	scf 2	No	~mr	raw consist.	PRI consist.	Product
0	0	1	0	1		0.714286	0.166667	0.166667
1	0	1	0	2		0.663333	0.303448	0.303448
1	0	0	0	1		0.560538	0.092593	0.092593
0	1	1	0	1		0.558081	0.258475	0.258475
0	0	0	0	4		0.500000	0.209302	0.209302
1	1	0	0	3		0.473180	0.195906	0.195906
0	1	0	0	6		0.470862	0.227891	0.227891
0	1	1	1	5		0.456204	0.159774	0.159774
0	1	0	1	4		0.444690	0.140411	0.140411
1	1	1	0	4		0.422466	0.196944	0.196944
1	0	1	1	4		0.395115	0.106157	0.106157
0	0	1	1	2		0.394422	0.025641	0.025641
1	0	0	1	2		0.331104	0.019608	0.019608
1	1	0	1	5		0.279670	0.055480	0.055480
1	1	1	1	41		0.233569	0.114411	0.121302
0	0	0	1	0				

Table 7-42 *Truth table views of reporting near miss error (negated)*

tf1	tf2	scf1	scf2	No	~nmr	raw consist.	PRI consist.	Product
0	1	0	1	4		0.836283	0.593407	0.593407
0	1	0	0	6		0.811189	0.698885	0.712121
1	0	0	0	1		0.780269	0.524272	0.524272
1	1	0	0	3		0.760536	0.548736	0.548736
0	0	0	0	4		0.750000	0.552632	0.552632
0	1	1	1	5		0.729927	0.497738	0.497738
1	0	0	1	2		0.665552	0.280576	0.280576
1	0	1	0	2		0.663333	0.405882	0.405882
1	1	0	1	5		0.591331	0.251418	0.261297
0	0	1	0	1		0.565714	0.155556	0.155556
0	1	1	0	1		0.560606	0.391608	0.391608
1	1	1	0	4		0.512821	0.304878	0.304878
1	0	1	1	4		0.465517	0.146789	0.146789
0	0	1	1	2		0.394422	0.084337	0.084337
1	1	1	1	41		0.381922	0.201471	0.235294
0	0	0	1	0				

Table 7-43 *Truth table views of acknowledging severe error*

tf1	tf2	scf1	scf2	No	sd	raw consist.	PRI consist.	Product	Cases consistent with row	Cases inconsistent with row
1	1	0	1	5		0.854489	0.815445	0.815445	22;32;43;48;52	
1	1	1	0	4		0.843712	0.755725	0.755725	7;82	25;58
1	0	1	1	4		0.836207	0.796792	0.796791	17;40;85	64
0	1	1	1	5		0.795621	0.658537	0.658537	44;77	28;36;79
1	1	1	1	41		0.791444	0.747705	0.836759	2;3;6;8;11;12;15;18;19;26;29;30;37;38;47;57;59;61;67;68;69;71;73;74;76;84	1;4;9;13;20;24;31;34;35;46;51;54;55;56;70
0	1	1	0	1		0.777778	0.582938	0.582938		33
1	1	0	0	3		0.766284	0.648415	0.648415	10;65	78
0	0	1	1	2		0.764940	0.682796	0.682796	21;27	
1	0	0	1	2		0.73913	0.659389	0.659389	41;83	
0	1	0	1	4		0.674779	0.505051	0.505051	66	42;53;62
0	0	1	0	1		0.628571	0.277778	0.277778		80
1	0	0	0	1		0.623318	0.368421	0.368421		63
1	0	1	0	2		0.620000	0.400000	0.400000	50	45
0	1	0	0	6		0.564103	0.404459	0.404459	5;14	16;23;39;81
0	0	0	0	4		0.470588	0.320755	0.320755	49	60;72;75
0	0	0	1	0						

Table 7-44 *Truth table views of acknowledging moderate error*

tf1	tf2	scf1	scf2	No	md	raw consist.	PRI consist.	Product	Cases consistent with row	Cases inconsistent with row
0	0	1	1	2		0.984064	0.962264	0.962264	21;27	
0	0	1	0	1		0.942857	0.000000	0.000000		80
1	0	1	1	4		0.922414	0.856383	0.856383	40;85	17;64
1	1	0	1	5		0.892673	0.793651	0.826446	22;32;43;52	48
0	1	1	1	5		0.874696	0.628159	0.628159	44	28;36;77;79
1	0	1	0	2		0.853333	0.536842	0.536842	50	45
1	1	1	0	4		0.851038	0.725225	0.725225	7;82	25;58
1	0	0	1	2		0.839465	0.515152	0.515152	83	41
0	1	0	1	4		0.827434	0.385827	0.385827		42;53;62;66
0	1	1	0	1		0.792929	0.374046	0.374046		33
1	1	0	0	3		0.787356	0.576336	0.576336	10;65	78
1	0	0	0	1		0.784753	0.000000	0.000000		63
1	1	1	1	41		0.768846	0.684854	0.824462	2;6;8;11;12;13;15;19;26;29;30;37;38;47;59;67;68;69;73;74;76;84	1;3;4;9;18;20;24;31;34;35;46;51;54;55;56;57;61;70;71
0	0	0	0	4		0.661765	0.000000	0.000000		49;60;72;75
0	1	0	0	6		0.585082	0.222707	0.222707	14	5;16;23;39;81
0	0	0	1	0						

Table 7-45 *Truth table views of acknowledging near miss error*

tf1	tf2	scf1	scf2	No	nmd	raw consist.	PRI consist.	Product
1	0	1	1	4		0.794540	0.406639	0.443439
0	0	1	1	2		0.780876	0.481132	0.481132
0	0	1	0	1		0.771429	0.000000	0.000000
1	1	1	0	4		0.724054	0.433584	0.433584
1	0	0	1	2		0.705686	0.366907	0.366907
1	1	0	1	5		0.690403	0.453552	0.457721
0	1	1	1	5		0.684915	0.274510	0.274510
1	0	1	0	2		0.683333	0.000000	0.000000
0	1	1	0	1		0.641414	0.256544	0.256544
1	1	1	1	41		0.638089	0.464386	0.608972
0	1	0	1	4		0.628319	0.225806	0.225806
1	1	0	0	3		0.593870	0.320513	0.320513
1	0	0	0	1		0.538117	0.000000	0.000000
0	0	0	0	4		0.441176	0.000000	0.000000
0	1	0	0	6		0.398601	0.165049	0.165049
0	0	0	1	0				

Table 7-46 *Truth table views of acknowledging severe error (negated)*

tf1	tf2	scf1	scf2	No	~sd	raw consist.	PRI consist.	Product
0	0	1	0	1		0.857143	0.722222	0.722222
1	0	0	0	1		0.780269	0.631579	0.631579
0	0	0	0	4		0.750000	0.679245	0.679245
1	0	1	0	2		0.746667	0.600000	0.600000
0	1	0	0	6		0.703963	0.595541	0.595541
0	1	1	0	1		0.689394	0.417062	0.417062
0	1	0	1	4		0.668142	0.494950	0.494950
0	1	1	1	5		0.605839	0.341463	0.341463
1	1	0	0	3		0.568965	0.351585	0.351585
1	1	1	0	4		0.516484	0.244275	0.244275
1	0	0	1	2		0.494983	0.340611	0.340611
0	0	1	1	2		0.494024	0.317204	0.317204
1	0	1	1	4		0.357759	0.203209	0.203209
1	1	0	1	5		0.357069	0.184555	0.184555
1	1	1	1	41		0.293945	0.145868	0.163241
0	0	0	1	0				

Table 7-47 *Truth table views of acknowledging moderate error (negated)*

tf1	tf2	scf1	scf2	No	~md	raw consist.	PRI consist.	Product	Cases consistent with row	Cases inconsistent with row
0	0	0	0	4		1.000000	1.000000	1.000000	49;60;72;75	
0	0	1	0	1		1.000000	1.000000	1.000000	80	
1	0	0	0	1		1.000000	1.000000	1.000000	63	
0	1	0	1	4		0.891593	0.614173	0.614173	42;53;62;66	
0	1	0	0	6		0.881119	0.777293	0.777293	5;16;23;39;81	14
0	1	1	0	1		0.876263	0.625954	0.625954	33	
1	0	1	0	2		0.830000	0.463158	0.463158	45	50
1	0	0	1	2		0.829431	0.484848	0.484848	41	83
0	1	1	1	5		0.788321	0.371842	0.371841	48	22;32;43;52
1	1	0	0	3		0.710728	0.423664	0.423664	78	10;65
1	1	1	0	4		0.606838	0.274775	0.274775	25;58	7;82
0	0	1	1	2		0.593625	0.037736	0.037736		21;27
1	1	0	1	5		0.566564	0.166667	0.173554	28;36;77;79	44
1	0	1	1	4		0.537356	0.143617	0.143617	17;64	40;85
1	1	1	1	41		0.373469	0.145814	0.175538	1;3;4;9;18;20;24;31;34;35;46;51;54;55;56;57;61;70;71	2;6;8;11;12;13;15;19;26;29;30;37;38;47;59;67;68;69;73;74;76;84
0	0	0	1	0						

Table 7-48 *Truth table views of acknowledging near miss error (negated)*

tf1	tf2	scf1	scf2	No	~nmd	raw consist.	PRI consist.	Product	Cases consistent with row	Cases inconsistent with row
1	0	1	0	2		1.000000	1.000000	1.000000	45;50	
0	0	1	0	1		1.000000	1.000000	1.000000	80	
1	0	0	0	1		1.000000	1.000000	1.000000	63	
0	0	0	0	4		1.000000	1.000000	1.000000	49;60;72;75	
0	1	0	1	4		0.891593	0.774193	0.774194	42;53;62;66	
0	1	0	0	6		0.881119	0.834951	0.834951	5;16;23;39;81	14
0	1	1	1	5		0.880779	0.725490	0.72549	28;36;44;77;79	
0	1	1	0	1		0.876263	0.743455	0.743456	33	
1	0	1	1	4		0.830460	0.510373	0.556561	17;40;64;85	
1	0	0	1	2		0.829431	0.633093	0.633094	41	83
1	1	0	0	3		0.808429	0.679487	0.679487	65;78	10
0	0	1	1	2		0.796813	0.518868	0.518868	27	21
1	1	1	0	4		0.788767	0.566416	0.566416	7;25;58	82
1	1	0	1	5		0.737874	0.537341	0.542279	22;43;48	32;52
1	1	1	1	41		0.525789	0.298187	0.391028	1;2;3;4;9;13;18;20;24;26;31;35;37;46;51; 54;55;56;57;61;68;69;70;71;73;84	6;8;11;12;15;19;29;30;34;38;47; 59;67;74;76
0	0	0	1	0						

Appendix 18 Additional Results tables (factors and views)

Table 7-49 *Solution terms for view that moderate error Always reported*

Moderate error *Always* reported	**tf1*~scf1*scf2 +**	**~tf1*~tf2*scf1*scf2**
Consistency	0.960803	0.984064
Raw coverage	0.149665	0.036783
Unique coverage	0.131794	0.018913
Cases consistent	22;32;41;43;48;52;83	21;27
Cases inconsistent	Nil	Nil
Consistency cut-off	0.957688	
Solution consistency	0.965047	
Solution coverage	0.168578	

Table 7-50 *Solution terms for view that moderate error Always acknowledged (negated)(Analysis X)*

Moderate error *Always* acknowledged (negated)	**~tf2*~scf1*~scf2 +**	**~tf1*~tf2*~scf2**
Consistency	1.000000	1.000000
Raw coverage	0.086149	0.086149
Unique coverage	0.017230	0.017230
Cases consistent	49;60;63;72;75;	49;60;63;72;80
Cases inconsistent		
Consistency cut-off	1.000000	
Solution consistency	1.000000	
Solution coverage	0.103378	

Table 7-51 *Solution terms for view that moderate error Always acknowledged (negated) (Analysis Y)*

Moderate error *Always* acknowledged (negated)	**~tf2*~scf1*~scf2 +**	**~tf1*~tf2*~scf2 +**	**~tf1*tf2*~scf1*scf2**
Consistency	1.000000	1.000000	0.891593
Raw coverage	0.086149	0.086149	0.136149
Unique coverage	0.017230	0.017230	0.102703
Cases consistent	49;60;63;72;75;	49;60;63;72;80	42;53;62;66
Cases inconsistent	Nil	Nil	Nil
Consistency cut-off	0.891593		
Solution consistency	0.925645		
Solution coverage	0.206081		

Table 7-52 *Solution terms for view near miss error Always acknowledged (negated) (Analysis X)*

Near miss error ***Always* acknowledged (negated)**	**~tf2*~scf2**
Consistency	1.000000
Raw coverage	0.094444
Unique coverage	0.094444
Cases consistent	45;549;0;60;72;75;80
Cases inconsistent	Nil
Consistency cut-off	1.000000
Solution consistency	1.000000
Solution coverage	0.094444

Table 7-53 *Solution terms for view near miss error Always acknowledged (negated) (Analysis Y)*

Near miss error ***Always* acknowledged (negated)**	**~tf2*~scf2 +**	**~tf1*tf2*~scf1*scf2**
Consistency	1.000000	0.891593
Raw coverage	0.094444	0.093287
Unique coverage	0.094444	0.070370
Cases consistent	45;549;0;60;72;75;80	42;53;62;66
Cases inconsistent	Nil	Nil
Consistency cut-off	0.891593	
Solution consistency	0.935611	
Solution coverage	0.164815	

Appendix 19 Truth tables factors and views (demographics)

Table 7-54 *Truth table views of reporting severe error (workplace setting and work role)*

tf1	tf2	scf1	scf2	racf	mx	No	sr	raw consist.	PRI consist.	Product	cases consistent	cases inconsistent
0	1	0	1	1	0	1	1	1.000000	1.000000	1.000000	53	
0	1	1	1	1	0	1	1	1.000000	1.000000	1.000000	44	
1	0	0	1	0	1	1	1	1.000000	1.000000	1.000000	83	
1	0	1	1	0	1	1	1	1.000000	1.000000	1.000000	17	
1	1	0	1	1	1	1	1	1.000000	1.000000	1.000000	48	
1	1	1	0	1	1	1	1	1.000000	1.000000	1.000000	58	
1	1	1	1	1	1	5	1	1.000000	1.000000	1.000000	6;12;18;26;30	
0	0	0	0	1	0	2	0	0.941176	0.894737	0.894737	75	
1	1	1	1	1	0	6	0	0.938519	0.938519	0.938519	15;29;34;67;74;76	
1	1	0	0	0	0	3	0	0.885312	0.859951	0.859951	10;65;78	
1	1	1	0	0	0	3	0	0.883408	0.869783	0.869783	7;25;82	
1	1	1	1	0	1	7	0	0.874687	0.874687	0.874687	1;2;8;11;55;71	54
1	1	0	1	0	0	4	0	0.872892	0.864078	0.864078	22;32;43;52	
1	1	1	1	0	0	23	0	0.867144	0.861812	0.884638	3;4;13;19;20;24;35;37;38;46;47;57;59;61;68;69;70;73;84	
1	0	1	1	0	0	3	0	0.851107	0.843220	0.843220	10;65;78	

0	1	1	0	1	0	1	0	0.848000	0.800000	0.800000	33	
0	1	0	0	0	0	5	0	0.844193	0.821429	0.821429	5;14;16;81	
0	1	0	1	0	0	3	0	0.734043	0.715100	0.715100	42;66	62
0	1	1	1	0	0	4	0	0.731481	0.720706	0.720706	28;36;77	79
0	1	0	0	1	0	1	0	0.723684	0.543478	0.543478		39
1	0	0	1	0	0	1	0	0.718391	0.671141	0.671141	41	
0	0	1	1	0	0	2	0	0.631841	0.631841	0.631841	21;27	
1	0	0	0	0	0	1	0	0.630872	0.471154	0.471154		63
1	0	1	0	0	0	1	0	0.608040	0.493507	0.493507	50	
0	0	0	0	0	0	2	0	0.500000	0.500000	0.500000	49	72
1	0	1	0	1	0	1	0	0.495050	0.328947	0.328947		45
0	0	1	0	0	0	1	0	0.200000	0.200000	0.200000		80
0	0	0	0	0	1	0						
0	0	0	0	1	1	0						
0	0	0	1	0	0	0						
0	0	0	1	0	1	0						
0	0	0	1	1	0	0						
0	0	0	1	1	1	0						
0	0	1	0	0	1	0						
0	0	1	0	1	0	0						
0	0	1	0	1	1	0						
0	0	1	1	0	1	0						
0	0	1	1	1	0	0						
0	0	1	1	1	1	0						
0	1	0	0	0	1	0						
0	1	0	0	1	1	0						
0	1	0	1	0	1	0						

0	1	0	1	1	1	0
0	1	1	0	0	0	0
0	1	1	0	0	1	0
0	1	1	0	1	1	0
0	1	1	1	0	1	0
0	1	1	1	1	1	0
1	0	0	0	0	1	0
1	0	0	0	1	0	0
1	0	0	0	1	1	0
1	0	0	1	1	0	0
1	0	0	1	1	1	0
1	0	1	0	0	1	0
1	0	1	0	1	1	0
1	0	1	1	1	0	0
1	0	1	1	1	1	0
1	1	0	0	0	1	0
1	1	0	0	1	0	0
1	1	0	0	1	1	0
1	1	0	1	0	1	0
1	1	0	1	1	0	0
1	1	1	0	0	1	0
1	1	1	0	1	0	0

Table 7-55 *Truth table views of reporting moderate error (workplace setting and work role)*

tf1	tf2	scf1	scf2	racf	mx	No	mr	raw consist.	PRI consist.	Product	cases consistent	cases inconsistent
0	1	0	1	1	0	1	1	1.000000	1.000000	1.000000	53	
0	1	1	1	1	0	1	1	1.000000	1.000000	1.000000	44	
1	0	0	1	0	1	1	1	1.000000	1.000000	1.000000	83	
1	1	0	1	1	1	1	1	1.000000	1.000000	1.000000	48	
0	0	1	1	0	0	2	0	0.980099	0.969466	0.969466	21;27	
1	0	1	1	0	0	3	0	0.979879	0.971989	0.971989	40;64	85
1	0	0	1	0	0	1	0	0.977012	0.961538	0.961538	41	
0	1	1	0	1	0	1	0	0.968000	0.950000	0.950000	33	
1	0	1	0	0	0	1	0	0.959799	0.904762	0.904762	50	
1	1	1	1	1	0	6	0	0.957340	0.956522	0.956522	15;29;34;67;74;76	
1	1	0	1	0	0	4	0	0.946822	0.924214	0.924214	22;32;43;52	
0	0	0	0	0	0	2	0	0.941176	0.894737	0.894737	49	72
1	0	1	1	0	1	1	0	0.940000	0.890909	0.890909		17
1	0	0	0	0	0	1	0	0.932886	0.830508	0.830508		63
0	1	0	0	1	0	1	0	0.921053	0.806452	0.806452		39
0	0	1	0	0	0	1	0	0.920000	0.714286	0.714286		80
1	1	1	0	0	0	3	0	0.908819	0.873967	0.873967	7;25;82	
0	1	0	1	0	0	3	0	0.890957	0.810185	0.810185	42;	62;66
1	1	1	1	1	1	5	0	0.87108	0.851703	0.936123	6;12;26;30	18
0	1	1	1	0	0	4	0	0.868827	0.76257	0.76257	77	28;36;79
1	1	0	0	0	0	3	0	0.865191	0.788644	0.788644	10;78	65;

1	1	1	1	0	0	23	0	0.836825	0.804491	0.859866	4;13;19;20;24;35;37;38;47;59;61;68;69;70;73;84	3;9;31;46;51;56;57
0	1	0	0	0	0	5	0	0.827196	0.768061	0.768061	14;16;81	5;23
1	1	1	1	0	1	7	0	0.800752	0.775424	0.828054	1;2;8;11;55	54;71
0	0	0	0	1	0	2	0	0.794118	0.708333	0.708333	75	60
1	0	1	0	1	0	1	0	0.643564	0.409836	0.409836		45
1	1	1	0	1	1	1	0	0.588235	0.000000	0.000000		58
0	0	0	0	0	1	0						
0	0	0	0	1	1	0						
0	0	0	1	0	0	0						
0	0	0	1	0	1	0						
0	0	0	1	1	0	0						
0	0	0	1	1	1	0						
0	0	1	0	0	1	0						
0	0	1	0	1	0	0						
0	0	1	0	1	1	0						
0	0	1	1	0	1	0						
0	0	1	1	1	0	0						
0	0	1	1	1	1	0						
0	1	0	0	0	1	0						
0	1	0	0	1	1	0						
0	1	0	1	0	1	0						
0	1	0	1	1	1	0						
0	1	1	0	0	0	0						
0	1	1	0	0	1	0						
0	1	1	0	1	1	0						
0	1	1	1	0	1	0						

0	1	1	1	1	1	0
1	0	0	0	0	1	0
1	0	0	0	1	0	0
1	0	0	0	1	1	0
1	0	0	1	1	0	0
1	0	0	1	1	1	0
1	0	1	0	0	1	0
1	0	1	0	1	1	0
1	0	1	1	1	0	0
1	0	1	1	1	1	0
1	1	0	0	0	1	0
1	1	0	0	1	0	0
1	1	0	0	1	1	0
1	1	0	1	0	1	0
1	1	0	1	1	0	0
1	1	1	0	0	1	0
1	1	1	0	1	0	0

Table 7-56 *Truth table views of reporting near miss severe error (workplace setting and work role)*

tf1	tf2	scf1	scf2	racf	mx	No	nmr	raw consist.	PRI consist.	Product	cases consistent	cases inconsistent
1	0	0	1	0	1	1		1.000000	1.000000	1.000000	83	
0	0	1	1	0	0	2		0.980099	0.969466	0.969466	21;27	
1	0	1	1	0	0	3		0.971831	0.955128	0.955128	40;64	85
0	0	1	0	0	0	1		0.968000	0.927273	0.927273	80	
1	0	1	1	0	1	1		0.940000	0.890909	0.890909		17
0	1	0	1	1	0	1		0.921053	0.806452	0.806452		53
1	0	1	0	0	0	1		0.884422	0.767677	0.767677	50	
0	1	1	1	1	0	1		0.856322	0.747475	0.747475		44
1	1	0	1	0	0	4		0.845655	0.717340	0.717340	22;32;43;52	
1	1	1	1	1	0	6		0.840652	0.812408	0.850077	15;29;34;74;76	67
1	0	0	1	0	0	1		0.833333	0.000000	0.000000		41
1	1	1	0	0	0	3		0.820628	0.744137	0.744136	7;25;82	
0	0	0	0	0	0	2		0.735294	0.000000	0.000000		49;72
0	1	0	1	0	0	3		0.728723	0.324504	0.324503		42;62;66
1	1	1	1	0	0	23		0.726020	0.636297	0.751837	9;19;20;24;35;38;47;59;68;70;73	3;4;13;31;37;46;51;56;57;61;69;84
1	1	1	1	0	1	7		0.713033	0.662242	0.744610	1;2;8;11	54;55;71
1	0	0	0	0	0	1		0.704698	0.000000	0.000000		63
0	1	1	1	0	0	4		0.699074	0.431487	0.431487		28;36;77;79
1	1	0	0	0	0	3		0.694165	0.396825	0.396825	10	65;78
1	1	1	1	1	1	5		0.653310	0.501253	0.716846	6;12	18;26;30
0	0	0	0	1	0	2		0.647059	0.586207	0.586207	75	60
0	1	1	0	1	0	1		0.608000	0.608000	0.608000	33	

1	1	0	1	1	1	1	0.600000	0.000000	0.000000		48
0	1	0	0	0	0	5	0.597734	0.264249	0.271277	14	5;16;23;81
1	1	1	0	1	1	1	0.588235	0.000000	0.000000		58
1	0	1	0	1	0	1	0.544554	0.352113	0.352113		45
0	1	0	0	1	0	1	0.328947	0.328947	0.328947		39
0	0	0	0	0	1	0					
0	0	0	0	1	1	0					
0	0	0	1	0	0	0					
0	0	0	1	0	1	0					
0	0	0	1	1	0	0					
0	0	0	1	1	1	0					
0	0	1	0	0	1	0					
0	0	1	0	1	0	0					
0	0	1	0	1	1	0					
0	0	1	1	0	1	0					
0	0	1	1	1	0	0					
0	0	1	1	1	1	0					
0	1	0	0	0	1	0					
0	1	0	0	1	1	0					
0	1	0	1	0	1	0					
0	1	0	1	1	1	0					
0	1	1	0	0	0	0					
0	1	1	0	0	1	0					
0	1	1	0	1	1	0					
0	1	1	1	0	1	0					
0	1	1	1	1	1	0					
1	0	0	0	0	1	0					

1	0	0	0	1	0	0
1	0	0	0	1	1	0
1	0	0	1	1	0	0
1	0	0	1	1	1	0
1	0	1	0	0	1	0
1	0	1	0	1	1	0
1	0	1	1	1	0	0
1	0	1	1	1	1	0
1	1	0	0	0	1	0
1	1	0	0	1	0	0
1	1	0	0	1	1	0
1	1	0	1	0	1	0
1	1	0	1	1	0	0
1	1	1	0	0	1	0
1	1	1	0	1	0	0

Table 7-57 *Truth table views of reporting severe error (negated) (workplace setting and work role)*

tf1	tf2	scf1	scf2	racf	mx	number	~sr	raw consist.	PRI consist.	Product
0	0	1	0	0	0	1		0.800000	0.800000	0.800000
1	0	1	0	1	0	1		0.752475	0.671053	0.671053
1	0	0	0	0	0	1		0.671141	0.528846	0.528846
0	1	0	0	1	0	1		0.671053	0.456522	0.456522
1	0	1	0	0	0	1		0.618090	0.506494	0.506493
0	0	0	0	0	0	2		0.500000	0.500000	0.500000
0	0	0	0	1	0	2		0.500000	0.105263	0.105263
1	0	0	1	0	0	1		0.425287	0.328859	0.328859
0	1	1	0	1	0	1		0.392000	0.200000	0.200000
0	0	1	1	0	0	2		0.368159	0.368159	0.368159
0	1	0	1	0	0	3		0.332447	0.284900	0.284900
0	1	1	1	0	0	4		0.307099	0.279294	0.279294
1	1	0	0	0	0	3		0.295775	0.140049	0.140049
0	1	0	0	0	0	5		0.283286	0.178571	0.178571
1	1	1	0	0	0	3		0.221226	0.130217	0.130217
1	0	1	1	0	0	3		0.199195	0.156780	0.156780
1	1	0	1	0	0	4		0.191959	0.135922	0.135922
1	1	1	1	0	0	23		0.146637	0.112385	0.115362
1	1	1	1	0	1	7		0.125313	0.125313	0.125313
1	1	1	1	1	0	6		0.061481	0.061481	0.061481
0	1	0	1	1	0	1		0.000000	0.000000	0.000000
0	1	1	1	1	0	1		0.000000	0.000000	0.000000
1	0	0	1	0	1	1		0.000000	0.000000	0.000000

1	0	1	1	0	1	1	0.000000	0.000000	0.000000
1	1	0	1	1	1	1	0.000000	0.000000	0.000000
1	1	1	0	1	1	1	0.000000	0.000000	0.000000
1	1	1	1	1	1	5	0.000000	0.000000	0.000000
0	0	0	0	0	1	0			
0	0	0	0	1	1	0			
0	0	0	1	0	0	0			
0	0	0	1	0	1	0			
0	0	0	1	1	0	0			
0	0	0	1	1	1	0			
0	0	1	0	0	1	0			
0	0	1	0	1	0	0			
0	0	1	0	1	1	0			
0	0	1	1	0	1	0			
0	0	1	1	1	0	0			
0	0	1	1	1	1	0			
0	1	0	0	0	1	0			
0	1	0	0	1	1	0			
0	1	0	1	0	1	0			
0	1	0	1	1	1	0			
0	1	1	0	0	0	0			
0	1	1	0	0	1	0			
0	1	1	0	1	1	0			
0	1	1	1	0	1	0			
0	1	1	1	1	1	0			
1	0	0	0	0	1	0			
1	0	0	0	1	0	0			

1	0	0	0	1	1	0
1	0	0	1	1	0	0
1	0	0	1	1	1	0
1	0	1	0	0	1	0
1	0	1	0	1	1	0
1	0	1	1	1	0	0
1	0	1	1	1	1	0
1	1	0	0	0	1	0
1	1	0	0	1	0	0
1	1	0	0	1	1	0
1	1	0	1	0	1	0
1	1	0	1	1	0	0
1	1	1	0	0	1	0
1	1	1	0	1	0	0

Table 7-58 *Truth table views of reporting moderate error (negated) workplace setting and work role)*

tf1	tf2	scf1	scf2	racf	mx	number	~mr	raw consist.	PRI consist.	Product
1	1	1	0	1	1	1		1.000000	1.000000	1.000000
0	0	1	0	0	0	1		0.800000	0.285714	0.285714
1	0	1	0	1	0	1		0.752475	0.590164	0.590164
1	0	0	0	0	0	1		0.671141	0.169491	0.169491
0	1	0	0	1	0	1		0.671053	0.193548	0.193548
1	0	1	0	0	0	1		0.618090	0.095238	0.095238
0	1	1	1	0	0	4		0.578704	0.237430	0.23743
0	1	0	1	0	0	3		0.534574	0.189815	0.189815
1	0	1	1	0	1	1		0.510000	0.109091	0.109091
0	0	0	0	0	0	2		0.500000	0.105263	0.105263
0	0	0	0	1	0	2		0.500000	0.291667	0.291667
1	1	0	0	0	0	3		0.496982	0.211356	0.211356
0	1	0	0	0	0	5		0.427762	0.231939	0.231939
1	0	0	1	0	0	1		0.425287	0.038462	0.038462
0	1	1	0	1	0	1		0.392000	0.050000	0.050000
0	0	1	1	0	0	2		0.368159	0.030534	0.030534
1	1	1	0	0	0	3		0.367713	0.126033	0.126033
1	1	0	1	0	0	4		0.351492	0.075786	0.075786
1	0	1	1	0	0	3		0.301811	0.028011	0.028011
1	1	1	1	0	0	23		0.274807	0.13111	0.140134
1	1	1	1	0	1	7		0.255639	0.161017	0.171946
1	1	1	1	1	1	5		0.181185	0.058116	0.063877
1	1	1	1	1	0	6		0.061481	0.043478	0.043478
0	1	0	1	1	0	1		0.000000	0.000000	0.000000

0	1	1	1	1	0	1	0.000000	0.000000	0.000000
1	0	0	1	0	1	1	0.000000	0.000000	0.000000
1	1	0	1	1	1	1	0.000000	0.000000	0.000000
0	0	0	0	0	1	0			
0	0	0	0	1	1	0			
0	0	0	1	0	0	0			
0	0	0	1	0	1	0			
0	0	0	1	1	0	0			
0	0	0	1	1	1	0			
0	0	1	0	0	1	0			
0	0	1	0	1	0	0			
0	0	1	0	1	1	0			
0	0	1	1	0	1	0			
0	0	1	1	1	0	0			
0	0	1	1	1	1	0			
0	1	0	0	0	1	0			
0	1	0	0	1	1	0			
0	1	0	1	0	1	0			
0	1	0	1	1	1	0			
0	1	1	0	0	0	0			
0	1	1	0	0	1	0			
0	1	1	0	1	1	0			
0	1	1	1	0	1	0			
0	1	1	1	1	1	0			
1	0	0	0	0	1	0			
1	0	0	0	1	0	0			
1	0	0	0	1	1	0			

1	0	0	1	1	0	0
1	0	0	1	1	1	0
1	0	1	0	0	1	0
1	0	1	0	1	1	0
1	0	1	1	1	0	0
1	0	1	1	1	1	0
1	1	0	0	0	1	0
1	1	0	0	1	0	0
1	1	0	0	1	1	0
1	1	0	1	0	1	0
1	1	0	1	1	0	0
1	1	1	0	0	1	0
1	1	1	0	1	0	0

Table 7-59 *Truth table views of reporting near miss error (negated) (workplace setting and work role)*

tf1	tf2	scf1	scf2	racf	mx	No	~nmr	raw consist.	PRI consist.	Product	Cases consistent	Cases inconsistent
0	0	0	0	0	0	2		1.000000	1.000000	1.000000	49;72	
1	0	0	0	0	0	1		1.000000	1.000000	1.000000	63	
1	0	0	1	0	0	1		1.000000	1.000000	1.000000	41	
1	1	1	0	1	1	1		1.000000	1.000000	1.000000	58	
0	1	0	1	0	0	3		0.869681	0.675497	0.675497	42;62;66	
0	1	0	0	0	0	5		0.841360	0.709845	0.728723	5;16;23;81	14
1	1	0	0	0	0	3		0.798793	0.603175	0.603175	65;78	10
0	1	1	1	0	0	4		0.771605	0.568513	0.568513	28;36;77;79	
1	0	1	0	1	0	1		0.752475	0.647887	0.647887	45	
1	1	0	1	1	1	1		0.733333	0.333333	1.000000	48	
0	1	0	0	1	0	1		0.671053	0.671053	0.671053	39	
0	1	0	1	1	0	1		0.671053	0.193548	0.193548	53	
1	0	1	0	0	0	1		0.618090	0.232323	0.232323		50
1	1	0	1	0	0	4		0.608301	0.28266	0.28266		22;32;43;52
0	0	1	0	0	0	1		0.592000	0.072727	0.072727		80
0	1	1	1	1	0	1		0.574713	0.252525	0.252525	44	
1	0	1	1	0	1	1		0.510000	0.109091	0.109091	17	
0	0	0	0	1	0	2		0.500000	0.413793	0.413793	60	75
1	1	1	0	0	0	3		0.478326	0.255864	0.255864		7;25;82
1	1	1	1	1	1	5		0.442509	0.197995	0.283154	18;26;30	6;12
1	1	1	1	0	0	23		0.404906	0.210026	0.248163	3;4;13;31;37;46;51;56;57;61;69;84	9;19;20;24;35;38;47;59;68;70;73
1	0	1	1	0	0	3		0.400402	0.044872	0.044872	85	40;64
0	1	1	0	1	0	1		0.392000	0.392000	0.392000		33
0	0	1	1	0	0	2		0.368159	0.030534	0.030534		21;27

1	1	1	1	0	1	7	0.343358	0.227139	0.25539	54;55;71	1;2;8;11
1	1	1	1	1	0	6	0.272271	0.143279	0.149923	67	15;29;34;74;76
1	0	0	1	0	1	1	0.000000	0.000000	0.000000		83
0	0	0	0	0	1	0					
0	0	0	0	1	1	0					
0	0	0	1	0	0	0					
0	0	0	1	0	1	0					
0	0	0	1	1	0	0					
0	0	0	1	1	1	0					
0	0	1	0	0	1	0					
0	0	1	0	1	0	0					
0	0	1	0	1	1	0					
0	0	1	1	0	1	0					
0	0	1	1	1	0	0					
0	0	1	1	1	1	0					
0	1	0	0	0	1	0					
0	1	0	0	1	1	0					
0	1	0	1	0	1	0					
0	1	0	1	1	1	0					
0	1	1	0	0	0	0					
0	1	1	0	0	1	0					
0	1	1	0	1	1	0					
0	1	1	1	0	1	0					
0	1	1	1	1	1	0					
1	0	0	0	0	1	0					
1	0	0	0	1	0	0					
1	0	0	0	1	1	0					

1	0	0	1	1	0	0
1	0	0	1	1	1	0
1	0	1	0	0	1	0
1	0	1	0	1	1	0
1	0	1	1	1	0	0
1	0	1	1	1	1	0
1	1	0	0	0	1	0
1	1	0	0	1	0	0
1	1	0	0	1	1	0
1	1	0	1	0	1	0
1	1	0	1	1	0	0
1	1	1	0	0	1	0
1	1	1	0	1	0	0

Table 7-60 *Truth table views of disclosure severe error (workplace setting and work role)*

tf1	tf2	scf1	scf2	racf	mx	No	sd	raw consist.	PRI consist.	Product	cases consistent	cases inconsistent
1	0	0	1	0	1	1		1.000000	1.000000	1.000000	83	
1	0	1	1	0	1	1		1.000000	1.000000	1.000000	17	
1	1	0	1	1	1	1		1.000000	1.000000	1.000000	48	
1	1	1	1	1	1	5		0.993031	0.992439	0.992439	6;12;18;26;30	
0	1	1	1	1	0	1		0.954023	0.864407	0.864407	44	
0	1	0	1	1	0	1		0.921053	0.000000	0.000000		53
1	1	1	0	0	0	3		0.890882	0.844350	0.844350	7;82	25
1	0	1	1	0	0	3		0.889336	0.863184	0.863184	40;85	
1	1	1	0	1	1	1		0.882353	0.000000	0.000000		
1	1	0	1	0	0	4		0.822309	0.784591	0.784591	22;32;43;52	
1	1	1	1	1	0	6		0.808030	0.782051	0.782051	15;29;67;74;76	34
0	1	1	0	1	0	1		0.800000	0.000000	0.000000		33
1	1	1	1	0	0	23		0.763782	0.701185	0.816484	3;19;37;38;47;57;59;61;68;69;73;84	4;9;13;20;24;31;35;46;51;56;70
0	0	1	1	0	0	2		0.756219	0.721591	0.721591	21;27	
1	1	1	1	0	1	7		0.755639	0.718615	0.846939	2;8;11;71	1;54;55
1	1	0	0	0	0	3		0.754527	0.648415	0.648415	10;65	78
0	1	1	1	0	0	4		0.753086	0.630485	0.630485	77	28;36;79
1	0	1	0	0	0	1		0.733668	0.589147	0.589147	50	
0	1	0	0	1	0	1		0.723684	0.000000	0.000000		39
1	0	0	1	0	0	1		0.718391	0.671141	0.671141	41	
1	0	0	0	0	0	1		0.630872	0.471154	0.471154		63
0	1	0	1	0	0	3		0.625000	0.515464	0.515464	66	42;62
0	0	1	0	0	0	1		0.560000	0.312500	0.312500		80

0	1	0	0	0	0	5	0.529745	0.433447	0.433447	5;14	16;23;81
0	0	0	0	0	0	2	0.500000	0.500000	0.500000	49	72
0	0	0	0	1	0	2	0.441177	0.000000	0.000000		60;75
1	0	1	0	1	0	1	0.39604	0.000000	0.000000		45
0	0	0	0	0	1	0					
0	0	0	0	1	1	0					
0	0	0	1	0	0	0					
0	0	0	1	0	1	0					
0	0	0	1	1	0	0					
0	0	0	1	1	1	0					
0	0	1	0	0	1	0					
0	0	1	0	1	0	0					
0	0	1	0	1	1	0					
0	0	1	1	0	1	0					
0	0	1	1	1	0	0					
0	0	1	1	1	1	0					
0	1	0	0	0	1	0					
0	1	0	0	1	1	0					
0	1	0	1	0	1	0					
0	1	0	1	1	1	0					
0	1	1	0	0	0	0					
0	1	1	0	0	1	0					
0	1	1	0	1	1	0					
0	1	1	1	0	1	0					
0	1	1	1	1	1	0					
1	0	0	0	0	1	0					
1	0	0	0	1	0	0					

1	0	0	0	1	1	0
1	0	0	1	1	0	0
1	0	0	1	1	1	0
1	0	1	0	0	1	0
1	0	1	0	1	1	0
1	0	1	1	1	0	0
1	0	1	1	1	1	0
1	1	0	0	0	1	0
1	1	0	0	1	0	0
1	1	0	0	1	1	0
1	1	0	1	0	1	0
1	1	0	1	1	0	0
1	1	1	0	0	1	0
1	1	1	0	1	0	0

Table 7-61 *Truth table views of disclosure moderate error (workplace setting and work role)*

tf1	tf2	scf1	scf2	racf	mx	No	md	raw consist.	PRI consist.	Product	cases consistent	cases inconsistent
1	0	0	1	0	1	1	1	1.000000	1.000000	1.000000	83	
0	0	1	1	0	0	2	0	0.980099	0.962264	0.962264	21;27	
1	0	1	1	0	0	3	0	0.971831	0.951219	0.951219	40;85	64
1	0	1	0	0	0	1	0	0.959799	0.864407	0.864407	50	
0	1	1	1	1	0	1	0	0.954023	0.864407	0.864407	44	
1	0	1	1	0	1	1	0	0.940000	0.890909	0.890909		
0	1	0	1	1	0	1	0	0.921053	0.000000	0.000000		53
0	0	1	0	0	0	1	0	0.920000	0.000000	0.000000		80
1	1	0	1	0	0	4	0	0.909209	0.833729	0.833729	22;32;43;52	
1	1	1	0	0	0	3	0	0.899851	0.827764	0.827763	7;82	25
1	1	1	1	1	1	5	0	0.871080	0.843882	0.932401	6;12;26;30	18
0	1	1	1	0	0	4	0	0.853395	0.564220	0.564220		28;36;77;79
1	0	0	1	0	0	1	0	0.833333	0.000000	0.000000		41
1	1	1	1	1	0	6	0	0.826851	0.799127	0.799127	15;29;67;74;76	34
0	1	0	1	0	0	3	0	0.808511	0.404959	0.404959		42;62;66
1	0	0	0	0	0	1	0	0.805369	0.000000	0.000000		63
0	1	1	0	1	0	1	0	0.800000	0.000000	0.000000		33
1	1	0	0	0	0	3	0	0.776660	0.576336	0.576336	10;65	78
1	1	1	1	0	0	23	0	0.759096	0.648714	0.822211	13;19;37;38;47;59;68;69;73;84	3;4;9;20;24;31;35;46;51;56;57;61;70
0	0	0	0	0	0	2	0	0.735294	0.000000	0.000000		49;72
0	1	0	0	1	0	1	0	0.723684	0.000000	0.000000		39

1	1	1	1	0	1	7	0	0.681704	0.578773	0.770419	2;8;11	1;54;55;71
1	0	1	0	1	0	1	0	0.643564	0.000000	0.000000		45
1	1	0	1	1	1	1	0	0.600000	0.000000	0.000000		48
0	0	0	0	1	0	2	0	0.588235	0.000000	0.000000		60;75
1	1	1	0	1	1	1	0	0.588235	0.000000	0.000000		58
0	1	0	0	0	0	5	0	0.555241	0.245192	0.245192	14	5;16;23;81
0	0	0	0	0	1	0						
0	0	0	0	1	1	0						
0	0	0	1	0	0	0						
0	0	0	1	0	1	0						
0	0	0	1	1	0	0						
0	0	0	1	1	1	0						
0	0	1	0	0	1	0						
0	0	1	0	1	0	0						
0	0	1	0	1	1	0						
0	0	1	1	0	1	0						
0	0	1	1	1	0	0						
0	0	1	1	1	1	0						
0	1	0	0	0	1	0						
0	1	0	0	1	1	0						
0	1	0	1	0	1	0						
0	1	0	1	1	1	0						
0	1	1	0	0	0	0						
0	1	1	0	0	1	0						
0	1	1	0	1	1	0						
0	1	1	1	0	1	0						
0	1	1	1	1	1	0						

1	0	0	0	0	1	0
1	0	0	0	1	0	0
1	0	0	0	1	1	0
1	0	0	1	1	0	0
1	0	0	1	1	1	0
1	0	1	0	0	1	0
1	0	1	0	1	1	0
1	0	1	1	1	0	0
1	0	1	1	1	1	0
1	1	0	0	0	1	0
1	1	0	0	1	0	0
1	1	0	0	1	1	0
1	1	0	1	0	1	0
1	1	0	1	1	0	0
1	1	1	0	0	1	0

Table 7-62 *Truth table views of disclosure near miss error (workplace setting and work role)*

tf1	tf2	scf1	scf2	racf	mx	No	nmd	raw consist.	PRI consist.	Product	cases consistent	cases inconsistent
1	0	0	1	0	1	1	1	1.000000	1.000000	1.000000	83	
1	0	1	1	0	1	1	0	0.940000	0.890909	0.890909		17
1	1	1	1	1	0	6	0	0.934755	0.920245	0.920245	15;29;34;67;74;76	
0	1	1	1	1	0	1	0	0.862069	0.000000	0.000000		44
0	0	1	0	0	0	1	0	0.840000	0.000000	0.000000		80
1	0	1	1	0	0	3	0	0.832998	0.371212	0.437500		40;64;85
0	0	1	1	0	0	2	0	0.825871	0.593023	0.593023	21	27
1	0	1	0	0	0	1	0	0.804020	0.000000	0.000000		50
0	1	0	1	1	0	1	0	0.789474	0.000000	0.000000		53
1	1	1	0	0	0	3	0	0.781764	0.542320	0.542320	82	7;25
1	0	0	1	0	0	1	0	0.747126	0.000000	0.000000		41
1	1	1	1	1	1	5	0	0.722997	0.653595	0.781250	6;12;30	18;26
1	1	0	1	0	0	4	0	0.687419	0.453515	0.453515	2;52	22;43
0	1	1	1	0	0	4	0	0.637346	0.294294	0.294294		28;36;77;79
1	0	0	0	0	0	1	0	0.604027	0.000000	0.000000		63
0	1	0	1	0	0	3	0	0.595745	0.243781	0.243781		42;62;66
1	1	1	1	0	1	7	0	0.593985	0.434555	0.633588	8;11	1;2;54;55;71
1	1	0	0	0	0	3	0	0.593561	0.331126	0.331126	10	65;78
0	0	0	0	0	0	2	0	0.588235	0.000000	0.000000		49;72
1	1	1	1	0	0	23	0	0.5691840	0.300045	0.430039	19;38;47;59	3;4;9;13;20;24;31;35;37;46;51;56;57;61;68;69;70;73;84

0	1	1	0	1	0	1	0	0.480000	0.000000	0.000000		33
1	0	1	0	1	0	1	0	0.445545	0.000000	0.000000		45
0	1	0	0	0	0	5	0	0.441926	0.205645	0.205645	14	5;16;23;81
1	1	0	1	1	1	1	0	0.400000	0.000000	0.000000		48
1	1	1	0	1	1	1	0	0.294118	0.000000	0.000000		58
0	0	0	0	1	0	2	0	0.294118	0.000000	0.000000		60;75
0	1	0	0	1	0	1	0	0.197368	0.000000	0.000000		39
0	0	0	0	0	1	0						
0	0	0	0	1	1	0						
0	0	0	1	0	0	0						
0	0	0	1	0	1	0						
0	0	0	1	1	0	0						
0	0	0	1	1	1	0						
0	0	1	0	0	1	0						
0	0	1	0	1	0	0						
0	0	1	0	1	1	0						
0	0	1	1	0	1	0						
0	0	1	1	1	0	0						
0	0	1	1	1	1	0						
0	1	0	0	0	1	0						
0	1	0	0	1	1	0						
0	1	0	1	0	1	0						
0	1	0	1	1	1	0						
0	1	1	0	0	0	0						
0	1	1	0	0	1	0						
0	1	1	0	1	1	0						
0	1	1	1	0	1	0						

0	1	1	1	1	1	0
1	0	0	0	0	1	0
1	0	0	0	1	0	0
1	0	0	0	1	1	0
1	0	0	1	1	0	0
1	0	0	1	1	1	0
1	0	1	0	0	1	0
1	0	1	0	1	1	0
1	0	1	1	1	0	0
1	0	1	1	1	1	0
1	1	0	0	0	1	0
1	1	0	0	1	0	0
1	1	0	0	1	1	0
1	1	0	1	0	1	0
1	1	0	1	1	0	0
1	1	1	0	0	1	0
1	1	1	0	1	0	0

Table 7-63 *Truth table views of disclosure severe error (negated) (workplace setting and work role)*

tf1	tf2	scf1	scf2	racf	mx	number	~sd	raw consist.	PRI consist.	Product	cases consistent	cases inconsistent
0	0	0	0	1	0	2		1.000000	1.000000	1.000000	60;75	
0	1	0	0	1	0	1		1.000000	1.000000	1.000000	39	
0	1	0	1	1	0	1		1.000000	1.000000	1.000000	53	
0	1	1	0	1	0	1		1.000000	1.000000	1.000000	33	
1	0	1	0	1	0	1		1.000000	1.000000	1.000000	45	
1	1	1	0	1	1	1		1.000000	1.000000	1.000000	58	
0	0	1	0	0	0	1		0.8000000	0.687500	0.687500	80	
0	1	1	1	1	0	1		0.706897	0.135593	0.135593		44
1	0	0	0	0	0	1		0.671141	0.528846	0.528846	63	
0	1	0	0	0	0	5		0.640227	0.566553	0.566553	16;23;81	5;14
1	0	1	0	0	0	1		0.618090	0.410853	0.410853		50
0	1	0	1	0	0	3		0.601064	0.484536	0.484536	42;62	66
0	1	1	1	0	0	4		0.578704	0.369515	0.369515	28;36;79	77
1	1	0	0	0	0	3		0.547284	0.351585	0.351585	78	10;65
0	0	0	0	0	0	2		0.500000	0.500000	0.500000	72	49
1	0	0	1	0	0	1		0.425287	0.328859	0.328859		41
1	1	1	0	0	0	3		0.408072	0.155650	0.15565	25	7;82
0	0	1	1	0	0	2		0.368159	0.278409	0.278409		21;27
1	1	0	1	0	0	4		0.352789	0.215409	0.215409		22;32;43;52
1	1	1	1	0	0	23		0.334068	0.157601	0.183516	4;9;13;20;24;31;35;46;51;56;70	3;19;37;38;47;57;59;61;68;69;73;84
1	1	1	1	1	0	6		0.311167	0.217949	0.217949	34	15;29;67;74;76
1	0	1	1	0	0	3		0.301811	0.136816	0.136816	64	40;85
1	1	1	1	0	1	7		0.244361	0.12987	0.153061	1;54;55	2;8;11;71
1	1	1	1	1	1	5		0.085366	0.007561	0.007561		6;12;18;26;30
1	0	0	1	0	1	1		0.000000	0.000000	0.000000		83

1	0	1	1	0	1	1	0.000000	0.000000	0.000000	17
1	1	0	1	1	1	1	0.000000	0.000000	0.000000	48
0	0	0	0	0	1	0				
0	0	0	0	1	1	0				
0	0	0	1	0	0	0				
0	0	0	1	0	1	0				
0	0	0	1	1	0	0				
0	0	0	1	1	1	0				
0	0	1	0	0	1	0				
0	0	1	0	1	0	0				
0	0	1	0	1	1	0				
0	0	1	1	0	1	0				
0	0	1	1	1	0	0				
0	0	1	1	1	1	0				
0	1	0	0	0	1	0				
0	1	0	0	1	1	0				
0	1	0	1	0	1	0				
0	1	0	1	1	1	0				
0	1	1	0	0	0	0				
0	1	1	0	0	1	0				
0	1	1	0	1	1	0				
0	1	1	1	0	1	0				
0	1	1	1	1	1	0				
1	0	0	0	0	1	0				
1	0	0	0	1	0	0				
1	0	0	0	1	1	0				
1	0	0	1	1	0	0				

1	0	0	1	1	1	0
1	0	1	0	0	1	0
1	0	1	0	1	1	0
1	0	1	1	1	0	0
1	0	1	1	1	1	0
1	1	0	0	0	1	0
1	1	0	0	1	0	0
1	1	0	0	1	1	0
1	1	0	1	0	1	0
1	1	0	1	1	0	0
1	1	1	0	0	1	0
1	1	1	0	1	0	0

Table 7-64 *Truth table views of disclosure moderate error (negated) (workplace setting and work role)*

tf1	tf2	scf1	scf2	racf	mx	number	~md	raw consist.	PRI consist.	Product	cases consistent	cases inconsistent
0	0	0	0	0	0	2		1.000000	1.000000	1.000000	49;72	
0	0	0	0	1	0	2		1.000000	1.000000	1.000000	60;75	
0	0	1	0	0	0	1		1.000000	1.000000	1.000000	80	
0	1	0	0	1	0	1		1.000000	1.000000	1.000000	39	
0	1	0	1	1	0	1		1.000000	1.000000	1.000000	53	
0	1	1	0	1	0	1		1.000000	1.000000	1.000000	33	
1	0	0	0	0	0	1		1.000000	1.000000	1.000000	63	
1	0	0	1	0	0	1		1.000000	1.000000	1.000000	41	
1	0	1	0	1	0	1		1.000000	1.000000	1.000000	45	
1	1	1	0	1	1	1		1.000000	1.000000	1.000000	58	
0	1	0	1	0	0	3		0.869681	0.595041	0.595041	42;62;66	
0	1	0	0	0	0	5		0.855524	0.754808	0.754808	5;16;23;81	14
0	1	1	1	0	0	4		0.810185	0.43578	0.43578	28;36;77;79	
1	0	1	0	0	0	1		0.743719	0.135593	0.135593		50
1	1	0	1	1	1	1		0.733333	0.333333	1.000000	48	
0	1	1	1	1	0	1		0.706897	0.135593	0.135593		44
1	1	0	0	0	0	3		0.696177	0.423664	0.423664	78	10;65
1	1	0	1	0	0	4		0.544747	0.166271	0.166271		22;32;43;52
1	1	1	0	0	0	3		0.518685	0.172237	0.172236	25	7;82
1	0	1	1	0	1	1		0.510000	0.109091	0.109091	17	
0	0	1	1	0	0	2		0.492537	0.037736	0.037736		21;27
1	0	1	1	0	0	3		0.450704	0.048781	0.048781	64	40;85
1	1	1	1	0	0	23		0.410419	0.140273	0.177789	3;4;9;20;24;31;35;46;51;56;57;61;70	13;19;37;38;47;59;68;69;73;84
1	1	1	1	0	1	7		0.374687	0.172471	0.229581	1;54;55;71	2;8;11
1	1	1	1	1	0	6		0.311167	0.200873	0.200873	34	15;29;67;74;76

1	1	1	1	1	1	5	0.224739	0.061181	0.067599	18	6;12;26;30
1	0	0	1	0	1	1	0.000000	0.000000	0.000000		83
0	0	0	0	0	1	0					
0	0	0	0	1	1	0					
0	0	0	1	0	0	0					
0	0	0	1	0	1	0					
0	0	0	1	1	0	0					
0	0	0	1	1	1	0					
0	0	1	0	0	1	0					
0	0	1	0	1	0	0					
0	0	1	0	1	1	0					
0	0	1	1	0	1	0					
0	0	1	1	1	0	0					
0	0	1	1	1	1	0					
0	1	0	0	0	1	0					
0	1	0	0	1	1	0					
0	1	0	1	0	1	0					
0	1	0	1	1	1	0					
0	1	1	0	0	0	0					
0	1	1	0	0	1	0					
0	1	1	0	1	1	0					
0	1	1	1	0	1	0					
0	1	1	1	1	1	0					
1	0	0	0	0	1	0					
1	0	0	0	1	0	0					
1	0	0	0	1	1	0					
1	0	0	1	1	0	0					

1	0	0	1	1	1	0
1	0	1	0	0	1	0
1	0	1	0	1	1	0
1	0	1	1	1	0	0
1	0	1	1	1	1	0
1	1	0	0	0	1	0
1	1	0	0	1	0	0
1	1	0	0	1	1	0
1	1	0	1	0	1	0
1	1	0	1	1	0	0
1	1	1	0	0	1	0
1	1	1	0	1	0	0

Table 7-65 *Truth table views of disclosure near miss error (negated) (workplace setting and work role)*

tf1	tf2	scf1	scf2	racf	mx	No	~nmd	raw consist.	PRI consist.	Product	cases consistent	cases inconsistent
0	0	0	0	0	0	2	1	1.000000	1.000000	1.000000	49;72	
0	0	0	0	1	0	2	1	1.000000	1.000000	1.000000	60;75	
0	0	1	0	0	0	1	1	1.000000	1.000000	1.000000	80	
0	1	0	0	1	0	1	1	1.000000	1.000000	1.000000	39	
0	1	0	1	1	0	1	1	1.000000	1.000000	1.000000	53	
0	1	1	0	1	0	1	1	1.000000	1.000000	1.000000	33	
0	1	1	1	1	0	1	1	1.000000	1.000000	1.000000	44	
1	0	0	0	0	0	1	1	1.000000	1.000000	1.000000	63	
1	0	0	1	0	0	1	1	1.000000	1.000000	1.000000	41	
1	0	1	0	0	0	1	1	1.000000	1.000000	1.000000	50	
1	0	1	0	1	0	1	1	1.000000	1.000000	1.000000	45	
1	1	1	0	1	1	1	1	1.000000	1.000000	1.000000	58	
1	1	0	1	1	1	1	0	0.933333	0.888889	1.000000	48	
0	1	0	1	0	0	3	0	0.869681	0.756219	0.756219	42;62;66	
1	0	1	1	0	0	3	0	0.861167	0.477272	0.562500	40;64;85	
0	1	0	0	0	0	5	0	0.855524	0.794355	0.794355	5;16;23;81	14
0	1	1	1	0	0	4	0	0.848765	0.705706	0.705706	28;36;77;79	
1	1	0	0	0	0	3	0	0.798793	0.668874	0.668874	65;78	10
0	0	1	1	0	0	2	0	0.746269	0.406977	0.406977	27	21
1	1	1	0	0	0	3	0	0.741405	0.45768	0.457680	7;25	82
1	1	0	1	0	0	4	0	0.740597	0.546485	0.546485	22;43	2;52
1	1	1	1	0	0	23	0	0.629272	0.397671	0.569961	3;4;9;13;20;24;31;35;37;46;51;56;57;61;68;69;70;73;84	19;38;47;59
1	0	1	1	0	1	1	0	0.510000	0.109091	0.109091	17	

1	1	1	1	0	1	7	0	0.462406	0.251309	0.366412	1;2;54;55;71	8;11
1	1	1	1	1	1	5	0	0.346690	0.183007	0.218750	18;26	6;12;30
1	1	1	1	1	0	6	0	0.247177	0.079755	0.079755		15;29;34;67;74;76
1	0	0	1	0	1	1	0	0.000000	0.000000	0.000000		83
0	0	0	0	0	1	0						
0	0	0	0	1	1	0						
0	0	0	1	0	0	0						
0	0	0	1	0	1	0						
0	0	0	1	1	0	0						
0	0	0	1	1	1	0						
0	0	1	0	0	1	0						
0	0	1	0	1	0	0						
0	0	1	0	1	1	0						
0	0	1	1	0	1	0						
0	0	1	1	1	0	0						
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0	1	0	0	0	1	0						
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0	1	1	0	0	1	0						
0	1	1	0	1	1	0						
0	1	1	1	0	1	0						
0	1	1	1	1	1	0						
1	0	0	0	0	1	0						
1	0	0	0	1	0	0						

1	0	0	0	1	1	0
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1	0	0	1	1	1	0
1	0	1	0	0	1	0
1	0	1	0	1	1	0
1	0	1	1	1	0	0
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1	1	0	0	0	1	0
1	1	0	0	1	0	0
1	1	0	0	1	1	0
1	1	0	1	0	1	0
1	1	0	1	1	0	0
1	1	1	0	0	1	0
1	1	1	0	1	0	0